ELECTRICAL REVIEW

ILLUSTRATED.

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VIEWS, NEWS AND INTERVIEWS.

A number of gambling houses in Indianapolis were successfully raided by the police the other night because the electric alarm bells failed to work. In this case an electrical failure worked a good result.

The cable tells us that Sir Edward Watkin is building a private chalet on the extreme summit of Snowden, where he is arranging what he claims will be the most powerful electric light in the world. He thinks it will be visible over the greater part of Wales, England and even part of Ireland.

An official of the New England Telephone Company recently stated that the messages it handled would require the employment of 10,000 messenger boys if they had to be carried through the streets instead of over the wire. This gives a pretty practical idea of the value of the telephone, which the average man does not appreciate until he is without it.

"Councilmen Brightbill and Fletcher have agreed to fight for the renewal of the electric light contract, if, after an examination of the company's books, they are satisfied that the price charged is not unreasonable." —*Bedford, Pa., Gazette.*

There is fitness in all things. What could be better than having an electric light bill introduced by a councilman of the name of Brightbill?

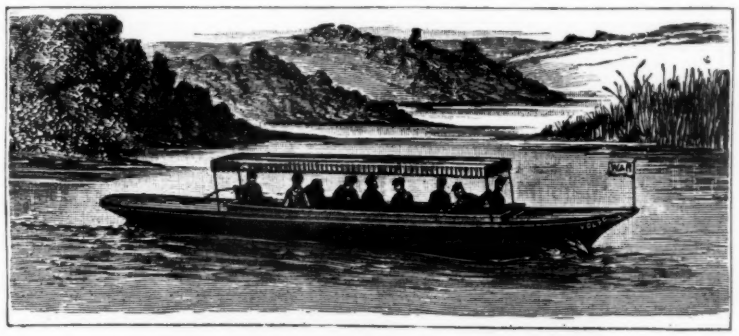
An electric railway in South St. Louis, Mo., has inaugurated an electric express for the carrying of express matter between the center of the city and the outskirts. All sorts of light freight, such as market baskets, packages and parcels of every kind, are carried for a small charge. Everyone is much pleased with the new scheme, and the railway officials are to be commended for their progressive spirit.

Last week the sloop "Lou" left San Diego, Cal., on a fishing excursion to last from one to three months. This statement does not become electrical news until it is known that an electric light plant has been put on board and that the fishing is to be done at night by means of incandescent lights. Four men, including the deviser of the fishing scheme, made up the crew. The idea is similar to that of "jacking" for deer. The fish, it is expected, will be attracted by the light and will thus be brought where they can see the bait. The result of the first voyage will be watched with great interest.

A peculiar blast was shot off at a South Bethlehem, N. Y., limestone quarry last week. It was expected that over 60,000 tons of limestone, forming a ledge 90 feet high and 400 feet long, would be dislodged at one time. The proprietor of the quarry had arranged an excursion to the place, and among the prominent guests was Governor Hill. The proprietor had sent to New York for an electrical expert to arrange the circuits which were to discharge the explosive. Something electrical went wrong, it is said, and the blast took place in sections, a little bit at a time. The proprietor was much enervated and told the expert to walk back to New York if he could find no other way.

An Electric Launch.

Our illustration on this page shows a government launch which is notable for the entire absence of a smokestack, smoke, steam and heat. It is stated to be the first electrically propelled craft built for the British Government and was successfully launched a short time since from the Strand Electric Launch Works, Chiswick, London. This boat is a pinnace, which has been built by Woodhouse and Rawson, Limited, for the conveyance of troops between the dockyards at Chatham and Sheerness. The "Volt" is 48 feet 6 inches long over all by 8 feet 9 inch



Electric Launch Belonging to the British Government.

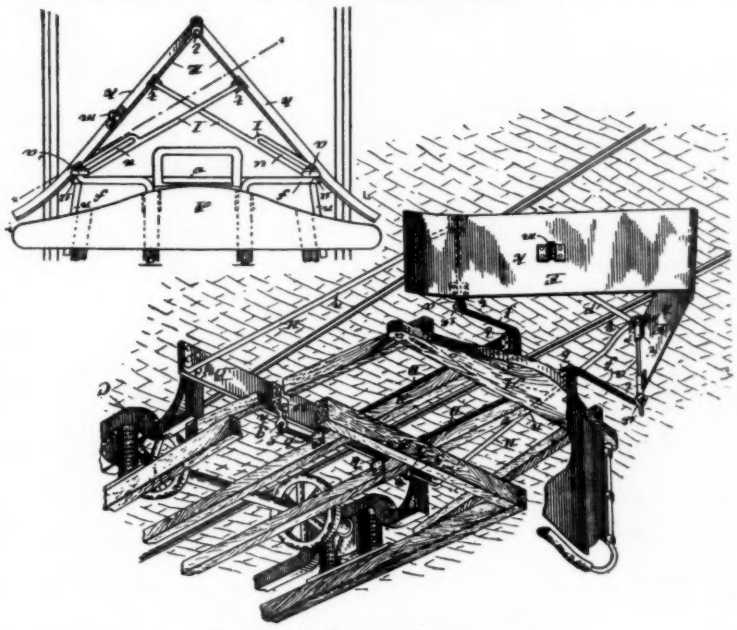
beam, with an average draught of 2 feet 3 inches; her full complement being 40 fully equipped soldiers. The storage batteries are placed under the seats along the sides of the pinnace, and the current is conducted to a Woodhouse and Rawson motor, which drives a two-bladed screw, 22 inches in diameter. The batteries are composed of 70 Epstein cells, and the motor will develop 5½ brake horse-power, and drive the screw propeller at 750 revolutions per minute. The anticipated speed on the measured mile is eight knots. The time of charging the cells with the electric current is six hours, and the charge will be sufficient to propel the boat for from 10 to 12 hours. For cases of emergency, the "Volt" will be fitted with two masts and two balance lugsails, thus enabling her to be sailed or propelled electrically, and to do the same work as a steam pinnace of her size.

Harvard Electric Club.

At the Annual Election of officers of the Harvard Electric Club, the following were chosen: President, G. S. Curtis, '92; vice-presidents, C. H. Arnold, '92, and P. L. Spaulding, '92; secretary, T. Hoppin, '92; treasurer, H. C. Smith, '93; librarian, P. W. Davis, '93. Members at large of executive committee, G. T. Page, '92; C. H. Arnold, '92, and H. Gregory, '92. The reports of officers showed that the Club was in fair financial condition, in spite of extra outlays for binding books, carpenter work, etc. The new officers are enthusiastic over the future of the Club.

Boston Electric Club.

At a regular meeting, held June 15, it was decided to bond the Club for $5,000 to fund and pay its indebtedness. The bonds are to be issued under the approval of the executive committee.



Fender for Electric Locomotive.

We have received from the publishing house of J. B. Baillerie & Son, Paris, advance sheets of "Dictionnaire d' Electricité et de Magnétisme," by Julien Lefevre, who has been assisted in its preparation by a competent force of engineers and electricians. The book will have 1,002 octavo pages, and 1,125 illustrations. Judging from the pages at hand it promises to be a valuable addition to electrical literature.

Fender or Life Guard for Electric Locomotives.

The accompanying engraving illustrates a fender or life guard for electric locomotives, recently patented by A. B. Hitchcock and Chas. S. Gorsting, of Brookline, Mass.

It is intended to operate precisely the same as the ordinary fender or cowcatcher on the steam railroad locomotives; and the principal feature of interest in the invention is the fact that while the car body oscillates vertically to so great an extent as seven inches each way, this fender remains at a given point about two inches and a half or three inches from the rail. This feature attracts all the more attention because the managers of the street railroads and the railroad commissioners of different States have given this subject considerable study since the use of electric cars.

It will be seen by the drawing that this fender is hung on a crank-shaft which is fastened to the bottom of the car body by means of links or bearings which allow the shaft to turn. At the opposite end of the shaft on the fender another arm is fastened by a link to the motor guard or some part of the truck which remains practically at a stationary point. This point being held rigidly, the end of the arm at the other end of the crank-shaft will also remain at a given point, while the car body is allowed to move up and down without changing the position of the fender.

This fender also possesses another feature which will interest railroad men, in that it is hung on pins or vertical rods and consists of two straight pieces of sheet iron which are fastened together in the center by a pin, and thus, when not in use, can be folded together so as not to take up additional room in the car house, and in fastening two cars together, it does not interfere with either the connecting rod or the close connection of the cars. In the construction of this fender there are no castings, and every part is made of forged iron, insuring the greatest strength. The mechanism is simple and cannot get out of order, and in every point it has been the study of the inventors to meet the demand for which the life guard was intended, and still adhere to the simplest practical mechanism, and provide an economical arrangement which will come within the reach of all railroad companies.

It might be added that this fender can be also constructed by an incline of the sides to give it more of a plow shape, and it has been provided with movable rods, to prevent any person or obstacle from falling over the fender and underneath the car, as shown in the figure at the right.

The first class to receive the degree of Electrical Engineer (E. E.) from Columbia College was graduated June 10. Five post-graduate students received the degree. They had first obtained a thorough collegiate education, and then taken a two years' course entirely devoted to strictly electrical engineering work, without being interrupted or confused by other studies at the same time. Prof. Francis B. Crocker writes that this plan is found to give most excellent results, and it certainly seems a logical method of pursuing a course of study in so difficult a subject as electrical engineering.

THE PROPHET'S COLUMN.

Electricity and nitrogen are two words which are seldom seen in apposition but they represent two of the most potent agencies in the universe. Nitrogen is one of the most valuable and, at the same time, the most abundant elements. About three-quarters of the atmosphere is composed of nitrogen and it enters as the principal article of food into all animal tissues. There is thus in the air above the earth a greater store of wealth than ever was or ever can be dug from all the mines under the earth. But how to make use of this treasure is the question. In its pure state, nitrogen is of no value as a food supply for either plants or animals and cannot be applied in the arts. It is pre-eminently the most inert substance in nature and only combines with other elements by the most round-about processes.

The alchemists of old sought in vain for the Philosopher's stone which was to convert the baser metals into gold, but the modern scientist should search for the key to this nitrogenous riddle. Why should any one starve while the very air we breathe teems with food supply?

If any man ever subdues this wayward element it will be an electrician, and why? Because by means of an electric spark the nitrogen of the air can be caused to combine with oxygen in such proportions as to form nitric acid. The production of nitric acid by electricity sounds like one of the discoveries of the nineteenth century, but such is not the case, for by every flash of lightning a small portion of nitric acid is formed.

If electricity can force nitrogen into one compound, why not into another? Here is a field in which electricity may some day give another manifestation of its wonderful power.

This is not the only hint which can be obtained from the lightning flash. Probably the first glass which was ever produced on earth was made by electricity. The lightning tubes which are familiar to geologists are really composed of glass, having been formed by the melting of the silica in the sand, by a discharge of lightning. Glass made with natural gas is advertised as of special quality. It is possible that some day the conflict between gas and electricity may be extended into the glass works.

The effect of an electric discharge upon oxygen is no less interesting than in the case of nitrogen. Oxygen so treated seems to undergo a complete change of properties. Instead of being a harmless gas without odor or effect on delicate colors or organic compounds, it acquires a pungent odor and rapidly rusts metals and bleaches the most permanent dyes. Electricity thus becomes a powerful agent in bleaching and, acting indirectly through ozone, may become in a new way an important factor in medicine. Ozonized oxygen, while not recognized as "officinal," has such a marked effect on organic structures that it has been looked upon with favor by many physicians, especially in diphtheritic affections.

Probably one of the most remarkable propositions yet made regarding the use of electricity is that of a New York barber who is at work on an electrical apparatus for making ozonized oxygen to be used in bleaching the hair! By this means he says he would avoid the use of dangerous dyes, which are a most prolific source of lead poisoning. Should this ambitious tonsorial artist succeed in his attempt, the "Electric Blonde" would soon displace her chemical prototype on the Rialto.

This profanation of electricity is not confined to barbers, for it is said that a manicure in this city, whose customers are composed principally of ambitious shop girls and dudish clerks, is perfecting a system of tanning the face "while you wait," producing by means of an arc light and a focusing lens, which is gradually moved about over the face, all of the nut brown effects which are so highly prized by summer tourists and which can only be produced naturally by the sun and fog of Bar Harbor.

THE PROPHET.

The "Tribune" Interviews Jay Gould.

HE IMPARTS AN OPINION ON TRANSIT MATTERS FROM HIS STANDPOINT AS PRESIDENT OF THE MANHATTAN ELEVATED RAILWAY.

Jay Gould has been interviewed several times recently. He has been lately more accessible to newspaper men than for years past. His latest opinions have been extracted from his system by the New York *Tribune*, and bear upon the rapid transit question. This interview winds up as follows:

"You spoke of the smoke of the London locomotives being a drawback to underground travel there. Would not the use of electric motors obviate this difficulty wholly?"

"It would, certainly, as to smoke; but it will take a long time and a large bank account to develop an electric motor and to educate New Yorkers to travel on an underground road."

"Commissioner Steinway recently alluded to the existence of electric motors capable of drawing heavy trains at the rate of 30 or 40 miles an hour. Do you know of any such inventions?"

"I presume I have had a hundred motors offered for sale with extraordinary claims by the inventors, but none have yet been perfected. When they are we shall be the first to adopt them."

"If such a motor exists it would doubtless have been shown to your company?"

"I think in all probability it would."

"Is not the propelling power of electricity limited, and to a very small horse-power at that?"

"I must leave electricity to experts. It is an unfathomable subject to me."

"Have the elevated railway engineers ever considered the use of electricity on the trolley system applied from wires below the cars, the wires resting on the road-bed as it now exists?"

"Yes, but we concluded to let well enough alone."

I had asked the last question with the hope of obtaining some definite expression from Mr. Gould which would interest Boston and Brooklyn people, just now bothered over the efforts of men to extend in the one and to introduce in the other city a dangerous system of propulsion which has but one thing to commend it—economy to the companies at the cost of the property-owners. Mr. Gould was not very elaborate, and might have been more definite in his expressions, but it is clear from his answer that the elevated road directors have examined and rejected the trolley system.

The reporter has endeavored, evidently, to get a very prominent person, like Mr. Gould, to condemn electric underground traction, and thus an opinion with a semblance of authority might get into circulation to the detriment of the electrical interests. Yet in the same issue of the *Tribune* appears this editorial comment on the interview:

Mr. Gould's distrust of underground roads is based largely upon the assumption that there is no electric motor in existence, or likely soon to be invented, capable of drawing heavy trains rapidly and economically over the required distances. Without pretending to expert knowledge on this point, we may venture to say that his opinion is not shared by many who have studied recent developments in London. We note also with interest that a well-known electrician and inventor has offered to make a practical test of this question, at great loss to himself in case of failure. The Rapid Transit Commissioners, moreover, are men of sagacity and experience scarcely inferior to Mr. Gould's, and obviously they are convinced that electricity can be satisfactorily applied to the work of transportation, for their plan expressly excludes steam locomotives, and in so doing practically enjoins the use of electric motors.

No American newspaper has made such senseless opposition to the introduction of the trolley system as the *Tribune*. But from the inconsistency existing in the present instance between its news and editorial columns, it would seem that either the *Tribune* has been converted or is trying to crawfish, or that pressure of an opposite polarity is being exerted.

Let us hope for the sake of the journal that Horace Greeley founded that the veil has been lifted and the *Tribune* sees the light.

The Telephone in Our Signal Service.

Among several new features to be added to the service of the United States Signal Corps is a telephone which can be transported at will, and which will always be ready for operation. This apparatus consists of a battery enclosed in a box, to be carried suspended from the shoulders of a man, as shown in Fig. 3, who also conveys on his back the box in which is the reel of connecting cable. The mouth and ear-piece are in one, and easily held in the hand while in use.

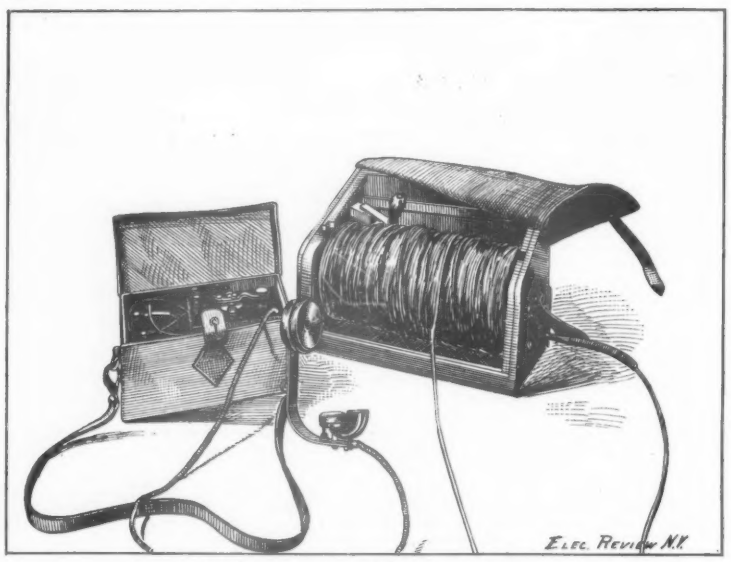


FIG. 1.—SIGNAL SERVICE PORTABLE TELEPHONE.

As the carrier operator walks, the reel is unwound and the wire falls on the ground. The instrument may be used as an ordinary telephone or for telegraphing. The transmitter is arranged for long-distance communication. The apparatus has already been tested and found to work satisfactorily. This device can be utilized day or night, and in a low country it becomes valuable where the heliograph or flag is useless.

This telephone system would be of much value, also, in army circles, but, it is stated, will not be adopted by the government at present because of the expense, but that it probably will be adopted when the telephone patents expire, when, it is thought, the expense will not be so great.

Engineering Association of the South.

The Regular June Meeting of the Association was held at the Y. M. C. A. Building, Nashville, Tenn., on Thursday evening, June 11, First Vice-President Dudley and President John B. Atkinson presiding in turn. A communication was received from the board of directors notifying the Association that permanent headquarters had been secured in the new Cumberland Publishing House, on Cherry street, Nashville, Tenn. The headquarters comprise a suite of three rooms, which may be thrown into one large room 43x23 feet on the second floor of this new building just nearing completion. The headquarters of the Association will be completed and in readiness for occupation before September 1.

ELECTRIC CLUBS.

New York Electric Club.

The First Smoking Concert, held at the Club the evening of June 18, proved to be a drawing attraction and great success. The entertainment committee of the Club were heartily congratulated by everybody present, and requested to try it again. In the absence of the president, Mr. Samuel Insull, Mr. T. C. Martin, as chairman of the entertainment committee, acted as master of ceremonies. The following well selected and enjoyable programme was presented with such fervor and enthusiasm as only electrical men can instil into what they have in hand:

FIRST PART.

Piano Solo, *Arragonaise* (From Le Cid), Massenet
Mr. George M. Phelps.

Song, { *The Daily Question*, G. H. Guy / *Love Comes Nevermore*, Lassen
Mr. C. McL. Paine.

Violin and Piano, (a) *Romanza*, Carl Bohm / (b) *Spanish Dance*, 1, Moszkowski
Messrs. R. Varley and Jos. Wetzler.

Musical Rec'n, *On the Banks of the Rappahannock.*
Mr. M. J. Sullivan.
An Incident of the Civil War. Introducing Popular Airs on Both Sides.

Piano Solo, *Magyar Dance*, G. H. Guy
Mr. G. H. Guy.
(Dedicated by permission to Mrs. Kendal and now performed for the first time in public by the Composer.)

'Cello, Violin and Piano, *Aria in D Major*, Bach
Dr. Leonard Waldo, Mr. Geo. M. Phelps and Master Fuller Waldo.

Phonograph Interlude.
Messrs. M. J. and M. C. Sullivan gave a Phonograph Recital, introducing a number of well-known solos and pieces of concerted music.

Song, *Bright Star of Love*, Robaudi
Master Fuller Waldo.

SECOND PART.

Song, *Exiled*, G. H. Guy
Mr. C. McL. Paine.

Violin and Piano, *Cavatina*, Raff
Messrs. R. Varley and Jos. Wetzler.

Song, with Banjo, "*In Other Respects We Are Doing Quite Well.*"
Mr. R. F. Outcault.
(A skit on electrical topics and oddities of the day.)

Piano, *Selections.*
Mr. F. R. Colvin.

Phonograph Interlude.
Messrs. M. J. and M. C. Sullivan.

When Mr. M. J. Sullivan was called upon for his musical recitation he excused the bad condition of his voice, by remarking that he had stayed out in a park late one night and left the gate open; however, the audience did not suffer much from this cause. The phonograph did especially good work, the cylinders being well selected and remarkably loud. Dr. Waldo and his talented young son honored the Club by coming all the way from Bridgeport to take part in the exercises. Mr. George M. Phelps, at very short notice, performed their accompaniments for them on the Steinway piano, which had been very kindly loaned for the occasion. Mr. George H. Guy's "Magyar Dance" was of exceptional merit, and Mr. Guy honored the Club by performing it in public for the first time at the smoking concert. Mr. Outcault's skit was, of course, very funny and performed in his usual artistic and inimitable style. Mr. Paine's voice seemed unusually sweet, and the obliging soloist was compelled to respond to several encores.

The large parlors and dining room of the Club were filled with small tables and chairs, and at each place long "church wardens" and a portion of tobacco were found. The contests between some of the short men and the long pipes were amusing in the extreme. One man had to hang his out of the window and then go out doors to light it.

Among the many members and guests present were the following: C. P. Elieson, London; Charles Dutton, R. B. Corey, Charles Lieb, Harold Binney, A. E. Colgate, Joseph Barré, Dr. Shain, Charles D. Shain, Lieut. S. D. Green, Dr. George H. Benjamin, Luther Stieringer, T. C. Martin, Joseph Wetzler, E. E. Bartlett, H. A. Foster, Geo. B. Coggeshall, George B. Muldaur, W. P. Kirchhoff, R. H. Read, H. R. Rogers, H. D. Stanley, George T. Manson, O. E. Madden, Theo. Beran.

It is expected that the New York State Board of Railroad Commissioners will render a report this week anent the introduction of the trolley system in Brooklyn.

Electricity in Dental Practice.

BY S. B. PALMER, M.D.S., SYRACUSE, N. Y.

In a commercial aspect, dentistry has received its share of benefits from the introduction of electrical appliances. Small motors furnish power to run lathes in the laboratory, the engine at the chair, the fan for circulation of air, the electro-magnetic mallet for condensing gold in filling, the mouth lamp for diagnosing for dead teeth, for the cautery and for maintaining heat in the points of instruments while working plastic fillings.

The inventor and investor have supplied even many others not necessary to mention, and the limit is not reached.

The above benefits mainly consist in labor saving, and in comfort both to patient and operator. Electricity has in store for coming patients far greater and more lasting benefits than the profession has been able to give, because even the rudimental teachings of electricity have not been required in dental education; with less than this the points which here follow cannot be discussed or appreciated.

We will consider the effects of electric potentials between fillings and such electrolytes as come in contact with them in the mouth, be it softened tooth structure, food or fluids, under the head of Electro Dental Physiology and Therapeutics, better known in the profession as the "Electro Chemical Theory."

Within 18 years the writer has presented a score of papers bearing upon this subject; discussions have followed and points have been gained, in keeping with empirical practice, until the so called theory has been absorbed in practice, which is not saying much for the triumph of science in modifying practice. In justice I should say that the Philadelphia Dental College has incorporated the principles in a text-book, from which students receive instructions in the "Electro Chemical Theory."

The most prominent points consist in this: That the saliva of the mouth, the food, condiments, etc., sustain the relations of a battery cell with its fluids. When any metallic substance is placed therein it, as in the ordinary cell, has its potential or polarity, be it a plate or filling. Whether the current is constant or intermittent, or whether it be injurious or not, depends upon conditions which every operator should understand, so as to anticipate results. Let us illustrate by gold fillings; gold, as all understand, is the choice of all filling material. It does not oxydize, wears well, looks rich, and pays well. Twenty years ago it bordered on quackery to allow that amalgam would preserve certain conditions of teeth better than gold; to-day the student is taught to adapt the filling to the tooth, in most cases without giving any scientific reason. The writer claims that gold fillings in the mouth come under the law as described in electro kinetics, relating to elements or plates when plunged in a battery cell, viz., of a higher potential than that of its surroundings. The effect of the current or electrolytic action therefrom becomes injurious to the tooth bone in contact, under the following circumstances: When tooth structure is so poorly calcified or is wanting in the lime element that it becomes a conductor, by reason of the fluid or moisture it contains, it becomes an electrolyte, in proportion to the conducting fluid entering into the compound. It so happens that normal tooth bone contains nearly two thirds inorganic or non-conducting matter, a large portion of which is of lime or of alkaline nature, which is readily dissolved by acids. The one-third is composed of organic matter of the nature of cartilage, containing organs of sense or nerve fibre. Teeth composed of these proportions, or even slightly less dense, may be safely filled with gold, for which there is no better material in use. But we find the teeth of children which early commence to decay, so soft or so nearly representing cartilage that preservation by filling with gold would be an impossibility, an operation violating well known electro chemical laws. Modern practice recognizes the necessity of using non-conducting fillings until the teeth mature. And yet the foundation principles for so doing are not given. I have not a word of complaint that the "electro chemical theory" has been received so slowly. There have been two potent hindrances; first, there is no *line* up between electrical science and dental science. The writer well knows the difficulty of presenting the one word *potential* in a manner to be understood by those who know not the rudiments of electrical science, and not less is the other hindrance mentioned, prejudice; because the teachings at first were against the highest practice of the times. Eighteen years ago, gold was considered almost a universal filling, while amalgam was despised, together with those who advocated its use. It will not take as many minutes for the reader to understand the relations of the two materials for teeth preservation, as it has years for some of the older members of the profession.

Let us dismiss the better class of teeth with the popular idea that gold *is* the best filling material, and consider teeth of low grade, such as are known to decay around gold in a few years. The first effect where filled with gold is from a thousand changes, from heat or cold, the result of which is to devitalize the surface in contact with the filling, which decomposition becomes visible by the dark shade seen through the enamel; this lining is moist and becomes an electrolyte according to molecular mobility; the acid resulting therefrom finds its affinity in the lime salts of the structure which gives space for fluid circulation. Gold, as a filling material, imparts no antiseptic properties, it is only to fill the cavity, to displace fermenting substances.

Amalgam, while it is not to be recommended for its appearance, does supply properties that gold never does. There is less difference in its potential. With the positive elements, it gives off oxides and sulphide, which are lodged in the bone in the spaces from which the lime has been dissolved, thus bringing the walls of the cavity to the same potential as the filling, when the current ceases without decay. In practice great disturbances occur when gold fillings are placed in close relations with base metals. With a knowledge of galvanic currents, all such excitement may be avoided; without such knowledge, all is guess work. Filling teeth has reached its highest elevation in mechanical skill, advancement must now be looked for through science. One of the methods most apparent is *insulation* by varnish, which will fill the spaces in the porous bone, instead of using the sulphide mentioned. This is being done to a limited degree, but not taught, as it will be, from a *potential* standpoint. The writer speaks from personal experiences rarely attained. Having at the outset a fascination for electrical science and being obliged to wear an artificial denture, which, from time to time, has embraced silver, gold, rubber, aluminum, etc., together with metallic fillings of various kinds and compounds, some of which have been combined for scientific purposes, has given practical knowledge that could not be obtained by by other means.

FIG. 3.—SIGNAL SERVICE PORTABLE TELEPHONE.—METHOD OF CARRYING.

By cultivation and observation, currents are readily detected between gold and other metals when not in the same teeth, so to speak; the mouth furnishes a galvanometer almost as sensitive to taste as that of the "frog's leg" is to sight. When the tongue bridges over or closes the circuit from fillings of different potentials, work is done on the line. Patients cannot describe the symptoms, none but an electrician could diagnose a case, nor can the subject be discussed by those having no such experiences

I claim no honors for the advanced position set forth. The object of appealing to the REVIEW is to protect the dental profession against false positions in electrical science; therefore, I kindly invite criticism that the doctrines may be purely scientific.

FIG. 2.—SIGNAL SERVICE PORTABLE TELEPHONE.—READY FOR USE.

Rutland, Vt.—Shaver Telephone Company; capital, $20,000.

Milwaukee, Wis.—Dederick Motor Company; capital, $250,000.

Peoria, Ill.—The Municipal Construction Company; capital, $100,000.

Superior, Wis.—Wisconsin Gas and Electric Company; capital, $250,000.

Holliston, Mass.—Holliston Gas and Electric Company; capital, $8,000.

Portland, Me.—Miller Electric Danger Signal Company; capital, $100,000.

Charleston, Ill.—Charleston Thomson-Houston Electric Company; capital, $40,000.

Chillicothe, Ill.—The Chillicothe Water, Electric Light and Power Company; capital, $50,000.

Santa Cruz, Cal.—Santa Cruz, Garfield Park and Capitola Electric Railway; capital, $100,000.

Alexandria Bay, N. Y.—The Alexandria Bay Electric Light and Power Company; capital, $7,500.

Kaukauna, Wis.—Kaukauna Electric Light Company has increased its capital from $30,000 to $50,000.

Minneapolis, Minn.—Standard Electric Corporation; capital, $10,000; to deal in mechanical and electrical appliances.

Atlanta, Ga.—Grant Park Electric Railway; capital, $100,000. Incorporators, H. L. Woodward, J. H. Mountain and E. B. Woodward.

Cleveland, O.—The Ford-Washburn Storelectro Company, incorporated in West Virginia; capital, $1,500,000; to manufacture electrical devices.

Post Falls, Idaho.—Idaho Telegraph and Telephone Company; capital, $10,000; to construct and operate telegraph and telephone lines in Kootenai County.

Portland, Ore.—Mount Hood Railway Company, capital, $250,000; to construct and equip railway, telephone and telegraph lines from East Portland to Pendleton.

Little Rock, Ark.—Southwestern Pacific Railway Company; capital, $8,000,000; to construct railway, telegraph and telephone lines between Little Rock and Hartford.

Pontiac, Ill.—Pontiac Light, Power and Fuel Company; capital, $16,000; to furnish light, heat and power. Incorporators, B. D. Lucas, H. D. Spencer, C. L. Caper, H. A. Foster.

Denver, Colo.—The Arapahoe Electric Company; capital, $500,000. Incorporators, E. W. Lowry, W. F. Henderson and J. C. Regan, of Denver; E. J. Riley, of Omaha; C. S. Penfield and J. D. McDonald, of Fremont, Neb.

Boston, Mass—Cartagena Terminal and Improvement Company, (Limited); capital, $725,000 (maximum authorized capital, $500,000,000); to acquire grants for building railroads, telegraph lines, electric plants, etc., in Colombia, S. A.

Sparta, Ill.—The Gaston Electrical Manufacturing Company; to manufacture, sell and apply all kinds of electrical and other machinery, appliances, apparatus or devices. Capital, $125,000; incorporators, J. E. Gaston, D. P. Barker and R. H. Rosborough.

A fire in Asbury Park, N. J., June 18, destroyed the power station and engine room of the Seashore Electric Railroad Company. The station was equipped with 16 dynamos and eight engines. The company operates four miles of railroad, belting Asbury Park. The total loss was about $50,000; insured for $20,000.

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These are the days when the electric fan is become a power in the land—and we all feel inclined to laud its merits.

Dr. Palmer's article, in this issue, on dental electricity, will prove interesting reading and should stir up a scientific discussion of electrical matters pertaining to the practice of dentistry.

Lineman Martin's opportunity came at Seabright, N. J., during the terrible fire that destroyed so many of its beautiful homes. Only thinking of his duty and doing it, he now finds himself famous with the right to be called a hero. That beautiful poem by ex-Senator Ingalls, which presented "Opportunity" as visiting every person once, receives a striking illustration here.

We learn from a foreign news budget that the Japanese government is striving to get the powers to sign the revised treaties, the object of which is to make all foreigners directly amenable to the native authorities. Pursuing a policy of gradual weeding out of all foreigners employed under the government, the latest step has been the dismissal of seven well-known gentlemen employed, respectively, in the telegraph and postal services, each of whom has been in the country a great number of years.

Englishmen of eminence honored the name of Michael Faraday, the great electrician, by ceremonies celebrating the anniversary of his birth. The Prince of Wales presided, and Lord Rayleigh spoke at length of the valuable work of this great student, discoverer and scientist.

The meeting of the Association of Railway Telegraph Superintendents, at Cincinnati, last week, proved to be of unusual interest and profit. That old-time telegrapher, the Hon. Charles Selden, of Baltimore, who is, however, still a young man, gave some new and entertaining history relating to the quadruplex that will attract the attention of all the early telegraphers. A full report of the meeting appears in this issue of the REVIEW.

At a meeting of the executive committee of the National Electric Light Association, held in Montreal, June 10, it was decided to change the date of the next convention from August 16, 17 and 18, to September 8, 9 and 10. The electrical exhibition, which promises to be one of the largest affairs of the kind ever attempted in this country, will open September 7, and remain open until the 16th.

Mr. Sprague's "rapid transit" challenge, published in the *Evening Post* last week, will be read with interest by electrical engineers generally, and by the editor of the *Sun* in particular. It is rather a pity, perhaps, that electrical matters should be treated in this *fin de siècle*, sensational manner, but in this case it is a question of carrying the war into Africa and meeting the discontented spirits on their own ground. We have no doubt but that Mr. Sprague's offer is made in all good faith, but we think there is very little probability of his being taken up; the average daily newspaper editor can scarcely be expected to possess the courage of his printed opinions to the extent of risking such a sum as $50,000.

Our illustrated description of the Thomson-Houston electric locomotive, which appeared in last week's issue, shows that the engineers of that company have devoted considerable time and brains to the development of electrical machinery for mill work. The handling of both raw material and finished products of a mill is now rendered a simple matter by the use of electrical apparatus. There are but few of the large mills that have not sufficient surplus power to operate an electric generator, the current from which, by the aid of electric motors, can be made to do certain classes of work much more satisfactorily and economically than can be accomplished in any other way. The mill and mine offer great possibilities to the inventor and the engineer, and it is certainly a matter of congratulation that the needs of these two fields are being so well looked after as they are to-day.

A FLOATING TRAIN.

Public credulity in the possibilities of electricity is so implicit, that the wildest freaks of the liveliest imagination are accepted with the utmost faith. We read the other day of a Salt Lake City genius (?) who has designed a train to float in air. His scheme is to provide a surface track with the rails elevated about two feet. The motor car will be provided with two pairs of wheels vertically superposed so that the track will lie between them. The whole train is to be rendered buoyant by gas tanks, so that it will be practically a *balloon*, simply guided in its course by the surface track.

"The car rests on wheels which in turn rest on the rails, but the tracks are so built that there are supplementary wheels below the others and running against a rail underneath the upper rail. The rim is very light, and the idea of lower wheels is to keep the car from running in the air should the buoyancy of the gas prove more than the weight of the car. The motor of any electric system may be used, and as the weight of the car on the track will be often reduced to zero, a maximum of lightness in track plant is possible, while a speed of 125 to 150 miles an hour may be attained with safety."

Perhaps it has not occurred to the inventor that when the weight of the car on the track is reduced to zero, and his drive wheels will spin in air instead of propelling the train. Trifles of this sort are sometimes overlooked by enthusiastic inventors.

ELECTRICAL TATTOOING.

It is to be hoped that the manicure mentioned by "The Prophet" in another column will have better success than attended a pseudo doctor of this city, whose specialty is the removal of superfluous hair from the face. It is well known that the passage of a current of electricity from two fine needles through the root of the hair destroys its vitality and causes it to drop out. In applying this electrolytic treatment to the face of a wealthy lady patient, the doctor used two ordinary steel needles. The result was a series of reddish brown tattoo marks on the woman's chin caused by the decomposition of the iron of the needles. This face doctor now uses needles tipped with gold.

ELECTRICITY AND HEALTH.

Dr. Roe, the president of the Monroe County, N. Y., Medical Society, believes that the electrical conditions of the atmosphere have considerable influence on the human organism. In a recent address, Dr. Roe said:

"The relation of the electrical condition of the atmosphere and of the earth to the conditions of our bodies is a subject but little understood, although we have every reason to believe that they are intimate and very important. The value of electricity produced artificially is so great in the treatment of diseases that there must be a direct connection between perverted conditions of atmospheric electricity and the production of diseased condition. It is believed that much of the exhilarating effect of a mountain region is due to the electrical influences that predominate there."

This is a matter that deserves a patient investigation by the medical fraternity. The beneficial influence of mountain air on certain types of disease, and of sea air on others, is universally acknowledged. How much of this is directly attributable to electricity will be very difficult to determine, but scientific investigation may show that electricity is the controlling agent. Once this conclusion is safely reached it will not tax the ingenuity of inventors heavily to develop apparatus for copying the seaside or mountain conditions, wherever desired, so that poor invalids may enjoy equal advantages in pursuit of health and strength with their rich neighbors. It has not been long since the orthodox physician was wont to look with contempt upon electro-therapeutics. The feeling has disappeared now and a disposition to test its merits for whatever purpose recommended is prevalent. The electrolytic administration of drugs incapable of application to the system through the stomach, the general adoption of faradic and galvanic currents for many different ailments, and the liberal use of electricity in cautery, all show its importance as a medical agent. It is likely to grow in importance. It is believed by able thinkers that it is the immediate cause of the functions of vitality, and its incidents, motion, sensation and perception. A broad field of investigation opens here, which challenges the attention of the ablest and most progressive minds. Doubtless, the future holds in store many revelations of electrical marvels in a physiological as well as in an industrial sense.

FINANCIAL.

Closing quotations of electric stocks, from F. Z. Maguire & Co., Electrical Securities, 18 Wall street, N. Y., Saturday, June 20, 1891. New York, Boston and Washington Stock Exchanges.

NEW YORK.	
Western Union Telegraph Co	80
American Telegraph & Cable	79
Central and South American	130
Mexican	200
Commercial Cable Co	
Postal Telegraph Cable	28
Edison General Electric Co	100
" " Deferred	
Consolidated Electric Light	
Edison Electric Illuminating Co	76
United States Electric Light	30
North American Phonograph	
BOSTON.	
Thomson-Houston Electric Co	43
" " " Preferred	25⅝
" " " Series C	
" " " Series D	7
" " International Co	
" Welding Co	
" European Welding Co	
Ft. Wayne Electric Co	12
Westinghouse Electric Mfg. Co	12¾
Detroit Electrical Works	
TELEPHONE:	
American Bell	201
Erie	48
New England	50
Mexican	1.27½
Tropical American	
MISCELLANEOUS:	
Edison Phonograph Doll	
WASHINGTON.	
Pennsylvania Telephone	24
Chesapeake and Potomac	62
American Graphophone	5¾
United States Electric Light (Wash'ton)	155
Eckington and Soldiers' Home Electric Railway	49½
Georgetown and Tennallytown	57

RAILWAY TELEGRAPH SUPERINTENDENTS.

ANNUAL MEETING IN CINCINNATI LAST WEEK.

The tenth annual meeting of this Association was called to order by President G. T. Williams, at the Grand Hotel, Cincinnati, Wednesday, June 17, at 10.30 A. M. The following members were present:

G. T. Williams,	President,	Cleveland, O.
P.W. Drew,	Secretary & Treasurer,	Chicago.
C. Selden,	B. & O. R.R.,	Baltimore.
A. R. Swift,	C.R.I. & P. R.R.,	Chicago.
C.W. Hammond,	Mo. Pac. R.R.,	St. Louis.
M. B. Leonard,	C. & O. R.R.,	Richmond, Va.
C. S. Jones,	Ill. Cen. R.R.,	Chicago, Ill.
E. A. Darlton,	R. & D. R.R.,	Washington, D.C.
G. L. Lang,	N.Y.& N.E. R.R.,	Boston, Mass.
G. M. Dugan,	Ill. Cen. R.R.,	Jackson, Tenn.
T. J. Higgins,	C.C.C. & St.L. R.R.,	Cleveland, O.
S. K Bullard,	M.K. & T. R.R.,	Sedalia, Mo.
H. C. Sprague,	K.C.,Ft.S &M. R.R.,	Kansas C.,Mo.
U. J. Fry,	C.M. & St.P. Ry.,	Milwaukee, Wis.
C. H. Smith,	I. I. & I. R.R.,	Kankakee, Ill.
A. R. Lingafelt,	C.R.I. & P. R.R.,	Topeka, Kan.
Robert Stewart,	C.R.R. of N.J.,	Elizabeth, N. J.
H. C. Reed,	M.L.S. & W. R.R.,	Milwaukee, Wis.
J. B. Stewart,	West Shore R.R.,	Weehawken, N.J.
J. W. Stacey,	Tex. & Pac. R.R.,	Marshall, Tex.
W. C. Walstrum,	N. & W. R.R.,	Roanoke, Va.
T. W. Parks,	I. & G. N.,	Tyler, Tex.
S. S Bogart,	(Honorary Member),	New York.
R. J. M. Danley,	C. S. & H. Ry.,	Columbus, O.
F. M. Duncan,	D. & R. G.,	Denver, Colo.
F. W. Wilson,	G. R. & I. R.R.,	Fort Wayne, Ind.
A. Hayward,	O. & M.,	Cincinnati, O.
K. McKenzie,	M. & O.,	Jackson, Tenn.
E. R. Adams,	P. & R. R.R.,	Reading, Pa.
W. D. Vincent,	B. & O. R.R.,	Pittsburgh, Pa.
W.P.McFarlane,	F. E. & M. V.,	Omaha, Neb.
G. B. Kimball,	B. & O.,	Newark, O.
J. L. Orbison,	C. H. & D. R.R.,	Cincinnati, O.
H. C. Hope,	C. St P.,M.& O.R.R.,	St.Paul, Minn.
Horace Johnson,	C. W. & B. R.R.,	Chillicothe, O.
W. P. Ward,	B. C. R. & N.,	Cedar Rapids, Ia.

Twenty-one new members were elected, as follows:

H. J. Adams,	B. & M. R.R.,	Alliance, Neb.
J. H. Jacoby,	LehighVal.R.R.,	Bethlehem, Pa.
W. P. Ward,	B.C.R.&N. R.R.,	Cedar Rapids, Ia.
A. D. Halliday,	D. & I. R. R.R.,	Two Harbors, Minn.
J. P. Boyle,	K. & W. R.R.,	Centreville, Ia.
W.P.McFarlane,	F.E.&.M.V.R.R.,	Omaha, Neb.
G. E. Evans,	L. &. N. R.R.,	Louisville, Ky.
E. R. Adams,	P. & R. R.R.,	Reading, Pa.
C. G. Sholes,	A.T. & S.F. R.R.,	Chicago, Ill.
K. McKenzie,	M. & O. R.R.,	Jackson, Tenn.
W. D. Vincent,	B. & O. R.R.,	Pittsburgh, Pa.
J. M. Egan,	St.L.&S.F. R.R.,	Springfield, Mo.
R. J. M. Danley,	C. S. & H. Ry.,	Columbus, O.
G. R. Kimball,	B & O. R.R.,	Newark, O.
E. R. Scottville,	B.O.&S.W. R.R.,	Chillicothe, O.
H. G. Johnston,	I. I. & I. R.R.,	Kankakee, Ill.
W. W. Jackson,	N.Y.&N.E. R.R.,	Providence, R. I.
J. W. Dawson,	K. & M. Ry.,	Charleston, W.Va.
F. Peters,	S. P. R.R.,	New Orleans.

Mr. Charles S. Jones, Illinois Central R. R., Chicago, Ill., was elected president, and L. H. Korty, Union Pacific R. R., Omaha, vice-president, for the ensuing year. P. W. Drew, of Chicago, was re-elected secretary and treasurer. Invitations to hold the next meeting at Denver, Colo., were presented from J. J. Burns, master of transportation, Denver & Rio Grande Railway, Hon. Platt Rogers, mayor of Denver, and Hon. John S. Routt, governor of Colorado.

Mr. A. R. Swift then took the floor and said that for the past two years he had been very desirous that the Association should meet at Denver, and believed that the occasion could be made one of the most profitable and enjoyable in its ten years' history. He took pleasure in presenting a letter from Mr. St. John, general manager of the Rock Island system, which was a most encouraging recognition of the work of the Association. The letter was read as follows, and it was voted that it be spread upon the minutes:

The Association of Railway Telegraph Superintendents should represent progress. The world today is watching for achievements, knowing full well that in the no distant future the element forced to serve you will be called upon to render far greater service than in the past. "Knowledge is power," and your meetings held for the purpose of obtaining increased knowledge must prove of benefit to mankind, and of very great benefit to the interests which you directly serve. We believe in your organization and its power for good, and have read its past proceedings and the papers presented by its members which were able and interesting, and desire to encourage its efforts.

Understanding that your present meeting will determine the location of the annual meeting of June, 1892, I want to suggest Denver, Colo., and to say through you to the president of your organization and its members, that should Denver be selected it will afford us much pleasure to extend the courtesy of free transportation to Denver and return to its members, and ladies, and to further aid in every way consistent to make the journey pleasant and enjoyable to all. Very truly,

E. St. John, General Manager.

It was voted unanimously to hold the eleventh meeting of the Association at Denver, on June 15, 1892. A telegram was read by the secretary from C. E. Case, secretary of the Train Despatchers' Association of America, in session at Toledo, Ohio, extending congratulations and good wishes of the Association. Messrs. A. R. Lingafeld, C. G. Sholes and F. M. Duncan, were appointed as a committee of arrangements to make preparations for the Denver meeting. Mr. Selden, from the committee on topics and papers, reported that such papers as were ready for presentation would be taken up at the Thursday afternoon session. Upon motion of Mr. J. B. Stewart, it was voted that the annual dues be raised from $3 to $5 after the current year.

THURSDAY'S SESSION.

Mr. S. S. Bogart gave notice that his paper on electric railways would be forwarded to the secretary to be printed in the minutes. A communication was received from a school of telegraphy in Minneapolis, inviting the co-operation of the Association.

President C. S. Jones, then took the chair.

The following paper was read by Mr. G. L. Lang. (It should be said in justice to Mr. Lang and others who prepared papers for this meeting, that owing to the disorganization of the committee, caused by the retirement of its chairman, the members were not called upon to prepare their papers until their arrival at Cincinnati, and consequently they were not as complete as they otherwise would have been.)

CARE AND MAINTENANCE OF ELECTRIC BLOCK SIGNALS.

Electric signals for keeping trains a certain distance apart, commonly called "block signals," are slowly but surely coming into use. The very able and exhaustive paper read by Mr. Stewart, one year ago, has placed before us various systems now in use. Other papers have called attention to the use and value of such signals, but no one has given us even a hint as to what was necessary to make these signals effective after they were once placed upon a railroad.

I find the usual condition to be something like this: Some smooth tongued representative of one of the various signal companies will secure an interview with the general manager, usually selecting a time when the recollection of some accident is fresh in his mind, and show to him how by his system such an accident would be impossible.

Cost of appliances and cost of erection are shown to be nothing compared to one first-class "tail ender."

No argument is necessary to demonstrate the value of such appliances, so the matter settles itself into a question of cost. Ordinarily not a word has been said about the cost of maintenance, so the official gets the idea that to once equip his road with signals the cost stops; that they will run themselves, so to speak, displaying automatically and continuously almost the intelligence of a human being. The signals are ordered, placed in position, and are found to work splendidly.

Soon engineers begin to report signals out of order, standing at "danger" improperly. The road master is probably notified, who knows no more about it than a child, except that it is "electric"; so he hunts up the telegraph lineman who knows but little more. The result soon is that all the signals are at "danger" and the company putting them in is notified that the signals are a failure. Upon investigation the signal company usually finds the whole trouble to be *want of care.*

Thus we see the signals have got a bad reputation through no fault of their own, while the general manager discovers that the first cost is but the beginning of the expense.

What I say may have a strong "chestnut" flavor to most of you, but knowing how many comparatively simple things I had to learn, or learn to apply when I commenced the care of signals, I venture to mention a few of the points where trouble is apt to appear. As my experience has been mainly with a battery signal, what I say will more particularly have reference to the systems using a battery.

First of all, select an intelligent man to take care of your signals, and impress upon him that eternal vigilance is the price of a perfect working signal. He should clean his battery zincs very often to keep the internal resistance at the minimum, the external resistance being merely nominal.

A point very generally understood by batterymen is, that a battery that will work a four ohm sounder for two weeks will only work a signal circuit of half an ohm resistance one week.

When the zinc becomes reduced one-half in size we do not notice it in a circuit of high resistance, but it is fatal to a circuit of very low resistance. In our service we have two circuits of different resistances; one from half of one to two ohms, the other from 10 to 20 ohms. We transfer the half consumed zincs from the lower to the higher resistance circuits, keeping up the efficiency of both batteries. Before leaving the subject of batteries I want to say that fully nine-tenths of the failures recorded on block signals can be legitimately charged to the battery showing that this is the main point to watch.

Another point that, if carefully and intelligently watched will save much anxiety and search for cause of trouble is the relay.

Every relay should be hermetically sealed so no dust can prevent the points from making sure and perfect connection.

Every relay should be protected by a lightning arrester of some kind, as strange as it may appear, relays in a circuit made up of the steel rails of the track and underground wires, with no line wire whatever, are often burned by lightning. Where the track is the circuit, the joints are usually bridged by wires fastened to the rails by rivets driven into holes drilled for the purpose. Here is something that requires very close watching.

The track workmen are often ignorant, careless or both, breaking the wires or loosening the wires on the rivets. A detecting galvanometer is a very valuable help in locating faults of this nature.

In systems using the tracks for the circuit, insulations are necessary to divide the track into suitable signal sections, as well as for other purposes. These require great care in first introducing, as well as watching from day to day.

The insulating material may be of wood, vulcanized fibre, leatheroid, laminar fibre or other suitable material. The exact manner of introducing these insulations varies on different roads.

The cost per signal for maintenance of double track block signals is not far from $40 per annum, varying somewhat, according to the traffic. Notwithstanding the expense of installing a complete signal system and expense of care, I believe their use to be an economy when the traffic is as heavy as is the case on some parts of most of our leading railroads.

By the aid of these automatic signals trains are run into and out of our cities safely at intervals of one, two or three minutes, regardless of fog or weather. Without signals this could not be safely accomplished. As I remarked in the beginning, the perfect working signal displays intelligence little short of human; never sleeps on duty and never gets drunk.

In discussing Mr. Lang s paper, Mr. Robert Stewart said that on the Central Railroad of New Jersey, trains were started out from one-quarter to one-half minute apart, some of the blocks being comparatively short.

In reply to an inquiry regarding damage from lightning, Mr. Lang said that during an electrical storm in May, seven relays were burned out which were connected with a track circuit, and having not more than ten feet of line wire. Previous to this storm they had not used lightning arresters for track circuits, but did so now. The form adopted was made of two plates of copper separated by paraffined paper.

Mr. Williams stated that several years ago on the Pan Handle Road, near Dalton, Ill., he saw 18 poles which had been struck and destroyed by lightning, although no wires were on them, it being a new line of poles. On the other side of the track the poles having wires on them were not disturbed.

Mr. M. B. Leonard, of the Chesapeake & Ohio Railroad, read a paper on the "Phonoplex for Railway Telegraph Lines." He said that with the increase of traffic there was a corresponding growth in the use of the railway telegraph, but it was frequently difficult for a superintendent to obtain additional facilities. It had, therefore, been necessary in many cases to adopt devices used by commercial telegraph companies to increase the carrying capacity of the wires. The phonoplex, besides increasing the capacity of existing lines, possessed several distinct advantages over the Morse apparatus. Its operation was not affected by the weather. In most instances it would work over a break in the wire where parallel wires existed, the induced current jumping over to the companion wire and thus bridging the break. The phonoplex formed a never-failing means of communication with all offices. The battery now used in connection with it is the Edison-Lalande. On the Chesapeake & Ohio line, during the December blizzard, all the wires were down between Clinton Forge and Richmond. The phonoplex worked steadily until the other wires were cleared up. The Kansas City and Fort Scott Railway had had a similar experience. He believed that in the Chesapeake & Ohio service the system had paid for itself several times over.

In response to an inquiry as to the nature of the damage to the line referred to, Mr. Leonard said that the wire was broken, crossed and grounded. They worked through the break by the induced current, but could not say which wire it was on. There were four stations between Clinton Forge and Richmond. The operation of the phonoplex could only be stopped by an absolute break, where there was no other wire for the current to pass over.

Mr. Robert Stewart inquired if it would work through a leaky wire in a seven conductor cable a mile in length, if so it would be valuable, as cables were expensive. No positive reply was elicited to this inquiry, and it was that it could only be determined by actual experiment.

Mr. Lang stated that it could not be worked on two wires strung on the same set of poles.

Mr. Selden stated that the Baltimore and Ohio Company has a wire 120 miles long with 30 stations which they wished to have equipped with the phonoplex, but after several months' experimenting, the attempt was abandoned as impracticable. He confirmed Mr. Leonard's statement that it would work over a break under the conditions stated. The Baltimore and Ohio Railroad has a set working between Philadelphia and Baltimore, and several sets in New York city. Their longest circuit was 91 miles, but circuits 300 miles long were worked on other roads.

Mr. Lang stated that between Hartford and Boston the phonoplex worked admirably up to within 40 rods of the Boston office, where the wire entered a cable 75 feet in length which contained a Western Union ticker wire. That made it practically useless.

Mr. U. J. Fry of the Chicago, Milwaukee and St. Paul Railway, read a paper on the "Quadruplex."

After a brief explanation of the apparatus, he referred to various applications which could be made besides it use between two stations. In their service they quadruplexed one wire between Chicago and Marion, Iowa, 225 miles, and work a single wire from Marion to Omaha, 30 miles into one side and another from Marion to Kansas City, 306 miles into the other side. This enables the Chicago office to work with any or all offices from Marion to Omaha, inclusive. Another wire between Chicago and Milwaukee is quadruplexed. They work a single wire from Milwaukee to Minneapolis, 345 miles on one side, and on the other side is worked a single wire, Milwaukee to Prairie du Chien, to Canton, South Dakota, 30 miles, during the the night, and in the daytime this circuit is disconnected and that side of the quadruplex is worked duplex. With this arrangement at Milwaukee, they are enabled to close the night offices, allowing the wires to work through giving the general office at Chicago access to the entire system through other night offices. With the aid of these combinations and automatic repeaters at junction points they can, during the daytime, place their general manager's office in direct communication with any division superintendent's office on the system at very short notice. They run two wires from the telegraph office to the general manager's office—one to a key and sounder for transmitting, the other to a sounder for receiving, thence to ground, and with the aid of four switches they can extend the local circuits of either quad. set down to his office on these two wires. The repeating sounder on No. 2 side in search of trouble. They have now entirely dispensed with this sounder by placing the reading local circuit in place of the repeating local circuit on the neutral relay and allow that relay to close the local on the back stop as before, then exchange the tap wire and long end, which places the short end of battery to line with key closed. Give signal on back stroke at distant end and the whole battery to line with key open, breaking local at distant end. This charge is found very beneficial in working single into quadruplex circuits, where it is necessary to keep keys closed in that, that when circuits are idle the short end is to line, preventing the heating of rheostat, which otherwise would occur, and require continual watching. This he believed to be the proper and most economical way of operating a quad because overcoming the danger of operators who worked on both quad. and single wires from leaving single wire keys open. This change necessitated closing the key on quadruplex wires as well as single wires, rendering the use of keys uniform. Mr. Fry also submitted a plan by which they expect to operate several quadruplex sets from one battery.

In the course of the discussion of Mr. Fry's paper, Mr. C. Selden availed himself of the opportunity to state that he felt a deep personal interest in the subject, and he believed he stood beside the bedside when the quadruplex was born. In 1869 he was located in Cincinnati, and in company with Mr. E. T. Gilliland was engaged in experimental electrical work. One day an old gentleman came in and wanted to know if he could get a Varley polarized relay. I told him we had none in stock, but could get him one. He wanted to know how long it would take and what it would cost. I said we could get it in a few days, but could not give him the price at that time. He stated that he was a poor farmer up at Mount Washington, and that I was the first person he had found who knew what a polarized relay was. After he had gone, Ned said (we always called him Ned, but his name is Ezra): "What did that old fellow want?"

"A polarized relay."

(*Continued on page 243.*)

Telephonic News

*** At the annual meeting of the Plymouth and Campton, N. H., Telephone Company, held last week, the following officers were chosen: President and treasurer, Plummer Fox; clerk, D. B. Keniston. A dividend of six per cent. was declared.

A New Trolley Clip.

A new trolley bell-hanger clip is illustrated in Fig. 1 on this page. The many superior points this clip has will be seen at a glance. In the first place, the two portions of the clip make a perfect hinge of themselves, doing away with a shaft or rivet as used in other hinge clips and which is a weak point. Adding to this that no solder or screws are used, this is one of the strongest and neatest in the market.

Fig. 2 illustrates the several parts, showing the interior of hard rubber bell, which, with the heavy bushing used, cannot be excelled in strength and insulation qualities. All the metal work is of the best heavy red brass.

Fig. 3 shows the hanger complete and gives the purchaser a good idea of a trolley bell clip that combines not only beauty and strength but saving of time and labor in line construction. With the superior points that this clip possesses it will undoubtedly become one of the most popular in the market. This hanger is sold exclusively by the Illinois Electric Material Company, 158 Fifth avenue, Chicago, Ill.

Vulcabeston.

For the comparatively brief time this article has been before the public, it has gained a popularity beyond the anticipations of the manufacturers, and is now universally recognized in the market as a standard insulating material for general electrical purposes.

Aside from its insulating merits, it also possesses great strength, does not contract or expand, and is fire and moisture proof.

Vulcabeston is furnished in moulded forms of almost any desired size and shape, and is particularly desirable for commutator heads, lamp bases, insulating parts of dynamos, switches, trolley bells, etc., and makes the best, and in the end the cheapest, field magnet spools that have been produced.

For steam and mechanical work special forms of vulcabeston are prepared, viz., piston rod packing, from one-sixteenth to two inches in diameter; flat packing from one-thirty-second to one-half inch in thickness, packing rings (concave and convex), moulded packing rings and gaskets for steam joints, union and faucet washers, pump valves, etc., etc., which on account of their toughness, elasticity and resistance to heat and moisture, render them the most durable and effective articles known.

The old established and well known house of H. W. Johns Manufacturing Company (New York, Boston, Chicago and Philadelphia) are selling agents for vulcabeston goods, and will gladly give estimates of cost and any other desired information.

Westinghouse Matters.

Mr. Westinghouse is said to have told his Boston friends last week that he had the assurance of the support of his plan of reorganization by enough more stock to bring the aggregate up to 110,000 shares. With this amount assented the plan would at once be put into operation. The Westinghouse Company's profits for the first half of the current year, or until June 30, will, it is said, be about $200,000. Under the reorganization Mr. Westinghouse is confident that the company can earn $1,000,000 net, per annum. The electrical interests in general will be benefitted by the continuance of this progressive company.

A Rough-and-Ready Dynamometer for Small Motors.

READ BEFORE THE ELECTRICAL SECTION OF THE FRANKLIN INSTITUTE, MAY 5, 1891, BY JOHN HOSKIN.

I have been requested to bring to your notice this evening a friction-brake dynamometer that is by no means new, but is one that is deserving of being more widely known by electricians than appears to be the case.

Like the well-known Prony brake, it acts as an absorption dynamometer, and without detracting from the acknowledged value of this instrument, especially for testing the value of large prime-movers, yet we need something more portable, more convenient to use, in the very numerous cases where it is desirable to test the efficiency of small motors.

We need a rough-and-ready instrument that is portable, inexpensive, readily used, and at the same time reliable.

This we find in a friction-brake dynamometer, one of the many modifications of those illustrated by Mr. William Worby Beaumont, in his paper on friction-brake dynamometers, read before the Institution of Civil Engineers in London, November 13, 1888, and published in 1889 in the Proceedings of the Institution.

Its construction requires only the use of a leather belt with a spring balance attached to one end, and a suitable weight at the other. The belt is to be thrown over the belt pulley of the motor, the spring balance is fastened to the floor base, or support of the motor to be tested, and the weighted end hangs pendant on the side of the pulley which, when in motion, will tend to lift the weight. When the motor is at rest, the strain of the weight should be read off on the spring balance. This reading we will call *W*. When the current is switched on and the motor runs at speed, the spring balance should again be read off, since the friction of the pulley on the belt will have a tendency to raise the weight; this reading we will call *W'*. The difference between *W* and *W'* in pounds, multiplied by the circumference of the pulley in feet (including one half the belt thickness on each side), and this by the number of pulley revolutions per minute will give the foot-pounds of mechanical energy, which can be compared with the electrical energy required to produce it, in the usual manner.

Thus, in a few minutes with the aid of a speed counter or tachometer, a voltmeter and an ammeter, the efficiency of a motor can be determined, and its ability to do a desired amount of work ascertained at once, instead of being left to guess work, as would often be the case if more bulky or elaborate apparatus were needed.

It should not be imagined from these remarks that this form of dynamometer is applicable to small motors only; but it is evident that for testing larger machines, where many horse-power have to be measured, the apparatus needs more elaboration, especially in the use of friction blocks under the belt or pulley strap, their lubrication, and the use of a dash-pot to steady the brake when the motive power is irregular.

But I need not enlarge on this, except to say that in these particulars, whether using steel strap, or leather belt with friction blocks, or rope friction, the same care is needed as in the Prony brake to obtain correct readings.

Before concluding, I submit to your consideration the value of the Waldron rotary pump for use as a dynamometer, although I have never heard that it has been applied to

FIG. 1.—A NEW TROLLEY CLIP.

that purpose. In examining one of these engines recently for other purposes it occurred to me that it would serve as an excellent dynamometer.

This pump is operated by rotary piston blades working in a chamber, without leakage, and with but small friction, the amount of which can readily be ascertained and calculated for use as a "constant." Its capacity per revolution, and the number of revolutions being known, as also the pressure against which it works, which can be regulated by a pressure gauge, the foot pounds of work are at once arrived at.

This method of measurement will correctly register the work done, although the speed may be irregular; and its results can be made more accurate than that of the friction dynamometer, because not subject to the irregularities arising from differences in lubricants, temperature, etc., which makes it necessary to use adjusting screws in most forms of friction-brake dynamometers.

FIG. 2.—A NEW TROLLEY CLIP.

FIG. 3.—A NEW TROLLEY CLIP.

Mr. Sprague's Offer.

The discussion of the question whether a suitable electric motor can be secured for the tunnel line which the New York rapid transit commissioners recommend has developed, among other things, an offer from an engineer and inventor to wager $50,000 that in a short time he can furnish such a motor, able to draw a train of cars at a speed of 40 miles an hour. It is said that a bet proves nothing, but in this case it at least emphasizes the scientific faith that is in this electrician.—*Brooklyn Eagle.*

The Value of Oil as an Insulator for High Voltage Currents.

READ BEFORE THE ELECTRICAL SECTION OF THE FRANKLIN INSTITUTE, MAY 5, 1891, BY DAVID BROOKS.

Even as late as 1884, in the electrical works, oils were placed among conductors. For instance, James T. Sprague, in the second edition of his book, places them among conductors "in the order of their specific gravity." His first patent for the use of oil as an insulator was taken out in 1878, and now the matter is receiving great attention among the electricians of Europe. In the London *Electrical Review* there is an account of tests by Siemens and Halske, of Berlin, in which they state that an ordinary Siemens electric light cable was inserted and broke down at a pressure of some 15,000 volts, but when oil was used, it perfectly withstood the pressure as high as 20,000 volts.

Oil has been used in Switzerland with complete success, not only for insulating wires, but also for transformers.

The writer has made the following experiment to show how much better oil is than the air for insulation. A large Holtz machine that sparked 7.5 inches through the air was unable to puncture the insulation of a cable of twisted wires separated one fourth of an inch, when immersed in oil.

The ends of the twisted wires were spliced to rubber-covered wires, and these were attached to the poles of the Holtz machine, after glass tubes had been drawn over them. The twisted wires were then placed in a jar containing oil with a layer of water floating on it, the oil being heavier than the water.

The spark broke through the tubes from wire to wire above the oil; the part of the jar containing water the tubes were broken opposite the splice, while the twisted wires in the oil stood the entire pressure of the machine, 7.5 inches spark. Such a spark would be equivalent to 175,000 volts, as defined by Warren De La Rue, between a point and a disk, but this spark of 7.5 inches was between two spheres, which requires a much higher voltage.

When no glass tubes were used to protect the conductors, the voltage or tension was much reduced by silent or brush discharge, blue sparks passing through the rubber covering. When bare wires were used to connect the two poles of the Holtz machine, still less tension was produced on account of leakage through the air.

The experiment tends to show that the air is not a good insulator for very high voltages, and also to confirm the experiments made in Switzerland as to the value of oil for insulating transformers, and protecting them from destruction by lightning.

Experiments have also been made with heavily insulated electric light cables for conveying high voltages. None of them stood a tension above 12,000 volts, and most of them broke down by the use of less than 10,000 volts.

British Telegraph and Patent Statistics.

Consul-General John C. New has rendered a report to the State Department under the broad heading of "The United Kingdom in 1889 and 1890." It is of a statistical nature and remarkably complete. Under the headings of "Telegraphs" and "Patents" the following information appears:

TELEGRAPHS.

The number of telegrams sent during the year was 62,403,399, against 57,765,347 in the previous year.

The following table shows the total cost of the telegraph service in each of the last five years:

Year.	Receipts.	Expenditures.			Deficit.
		Telegraph vote.	Votes of other departments.	Total.	
1885–'86	$8,936,330	$8,695,520	$490,685	$9,186,205	$1,857,770
1886–'87	9,495,800	9,698,820	461,340	10,160,160	2,370,445
1887–'88	9,964,745	9,641,725	353,440	9,995,165	1,692,505
1888–'89	10,649,895	9,846,620	360,185	10,206,805	1,325,915
1889–'90	11,819,180	10,907,360	404,190	11,311,550	988,450

POSTAL REVENUES AND EXPENDITURES.

Receipts:

Postage on letters, parcels, etc.	$45,734,205
Commission on money orders	648,140
Commission on postal orders	977,025
Value of unclaimed money orders	14,500
Savings bank	1 865,020
Revenue from telegraphs	11,819,180
	$61,058,070

Expenditures:

Postal service (including money order and postal order business)	$28,004,440	
Packet service	3,326,875	
Savings bank	1,684,770	
Telegraph service	11,311,550	
		44,327,635
Net revenue		$16,730,435

The net revenue shows an increase of $732,215 over the previous year.

PATENTS.

The number of applications for patents in 1889 was 21,008, exceeding those of 1888 by nearly 10 per cent.

The number of applications from persons resident in the United Kingdom was 16,019, an increase of 1,168 when compared with 1888. The applications from foreign countries numbered 4,989, of which number 1,857 were from the United States. The number of applications from the United States in 1888 was 1,457.

The revenue of the patent office from all sources was $864,100, and the expenses $396,430, thus leaving a surplus of $467,670.

The following table gives the total number of applications for patents, designs and trade-marks in each year from 1884 to 1889:

Year.	Patents.	Designs.		Trade-marks.
		Single.	Sets.	
1884	17,110	19,515	238	7,104
1885	16,101	20,388	337	8,026
1886	17,176	23,717	324	10,677
1887	18,051	25,734	309	10,586
1888	19,103	25,923	316	13,315
1889	21,008	24,370	335	11,316

Under authority of the patents, designs and trade-marks act, 1888, the Board of Trade have drawn up certain rules relating to the registration of patent agents, which provide that the registrar of the institute of patent agents shall keep a list of all patent agents permitted to practice as such. In order to obtain registration, a person must give proof that prior to the passing of the act he had been practicing as a patent agent, or otherwise he must pass an examination to be fixed by the institute of patent agents. No other person is now allowed to practice as a patent agent. The rules also provide for the striking off of any persons name who has been proved to have been guilty of any misdemeanor or disgraceful professional conduct. The fees payable for registration of name of patent agent are £5 5s. on registration and an annual fee of £3 3s., equal, respectively, to $26.25 and $15.75.

Long-Distance Transmission of Power by Electricity.

We are indebted to the "*Dictionaire D' Electricité et de Magnétisme*," by Julien Lefèvre, for the accompanying illustration, representing the arrangement of circuits and transformers in a long-distance system of transmission to supply the town of Dieulefit, France. The power station is established at Béconne and supplies two small towns, Valréas and Dieulefit, the first being 14 kilometers, and the second 5 kilometers distant. The water power utilized is furnished by a canal and has a fall of 21 meters. A reservoir of a capacity of about 13,000 cubic meters acts partly as a fund for reserve power, and partly to maintain the constancy of the fall. It represents a reserve of 800 electrical horse-power in the secondary system. The water is carried by two iron pipes .8 of a meter in diameter through two horizontal turbines, giving each a force of 50 horse-power, making 180 turns a minute. The regulation of the turbines is accomplished by means of a hydraulic regulator changing the supply of water according to the power consumed. Each of these turbines operates an alternating current machine, of the Zipernowsky system, of 24,000 watts at 2,000 volts and 12 amperes, and an exciting generator able to produce 3,000 watts at full charge. Each of the machines, with its exciter and accessory parts, supplies one of the two villages. The secondary tension is maintained constant in the two towns by two automatic rheostats. The two lines which conduct current to the towns are aerial throughout, and are formed of bare wires supported on porcelain insulators.

DISTRIBUTION FROM ZIPERNOWSKY TRANSFORMERS, AT DIEULEFIT, FRANCE.

The Dieulefit line, which is the shorter, is formed of a silicon bronze wire 3.2 millimeters in diameter, and has a resistance of 11.8 ohms. That of Valréas is formed of a cable of the same material, having a cross-section of 33 millimeters and 16.1 ohms resistance. Two telephone wires mounted on the same poles as the power conductors establish between the power station and the two towns the necessary communication for carrying out service. In the towns the conductors are chiefly mounted on supports fixed to the ridges of the houses and inaccessible to the public. The circuits are of different forms, according to the configuration of the two towns. At Valréas, which presents almost the form of a circle, distribution has been made in the form of a group radiating from a single central point. At Dieulefit, however, it is different, extending longitudinally over a distance of about three kilometers. In each of the towns the primary circuit supplies secondary transformers of the Zipernowsky, Deri & Blathy system. These transformers are placed in zinc cases on brass brackets, and mounted on the outside walls of the houses as seen in the engraving. In the streets the secondary wires which feed the lamps are bare like the primary conductors. For the public lamps and the private installations they are carefully insulated. The installation of Dieulefit comprises 115 lamps, of which 16 of 16 candle-power are for public lighting, three of the same intensity and 55 of 10 candle-power are for private lighting. The town of Valréas has 66 lamps of 16 candle-power for public lighting, and for private lighting 20 lamps of 5 candle-power, 101 lamps of 10 candle-power, and 46 lamps of 16 candle-power, making a total of 233 lamps.

One of Our Heroes.

In foreign lands acts of human bravery are rewarded with decorations and medals. The average American, in a certain sense, despises these things, and feels fully compensated for any brave action of his, resulting from quick wit and presence of mind, by the praise of his fellows. Had we a Victoria Cross, or corresponding emblem, W. D. Martin, a lineman stationed at Long Branch, N. J., in the employ of the New York and New Jersey Telephone Company, would be fully entitled to it. Martin has distinguished himself as a life-saver, and is a man the whole electrical field should be proud of.

We have all read of the conflagration at Seabright, N. J., which last week destroyed 400 houses and left a blackened waste where once was a snug seaside village. When the fire was discovered, Martin found that the usual means of communication were destroyed, both the telephone and telegraph offices being among the first buildings consumed. Martin, however, secured his testing set and tried to ascend a pole. The pole was set afire by falling sparks from the blazing buildings, and scorched and burning, he climbed a second pole; cutting the wires, he put his testing set in circuit, and warned the fire departments at Asbury Park and Long Branch of the terrible need of help. The result was that a special train arrived soon after with fire engines, and a considerable part of the town was saved.

The New York *Sun*, in commenting on Martin's brave deed, speaks as follows:

"Martin dared to act when he had no orders. He saw the meaning of the moment and acted accordingly. Did not he take life in hand to save the lives of others? Did not he neglect all rules and dare to assume the whole responsibility? And is not Martin a man to be honored above most men? Insight and promptness and daring—are not these things the test of a man, and has not Martin proved himself worthy in a way that could be tested by no examination, however honest or minute?"

The gratitude of people saved, the hearty pat on the back from press and public, and Martin's own satisfaction at the accomplishment of a heroic deed, will be sweet and soothing solace to his bruises and burns.

Queen's New Bunsen Photometer.

Queen & Co., Philadelphia, have recently made a large standard photometer, designed for the measurement of incandescent lamps, for the Standard Lamp Company, Appleton, Wis. This photometer differs from the large ones previously made in that it has special attachments for holding and testing the lamps which enable the work to be done rapidly as well as accurately. The instrument may be briefly described as follows: Two tables, about four feet high (with drawers in them for accessories), support the standard bar which is made of brass 500 centimetres long and graduated in 1,000 equal parts.

The left hand table carries a sensitive candle balance arranged for weighing the candle while in use. A standard Methvin burner is furnished in addition, which gives a uniform gas flame, which has been found much more reliable than the candle flame.

On the right hand table is a special lamp holder which can be rotated so as to present any part of the lamp to the sight box. This holder is extremely convenient, as it is only necessary to insert the lamp in the socket when a test is made, all connections being from below. A sight box on wheels moves along the bar and curtains are provided to shut out all light except from the Standard and the lamp under test.

TELEGRAPHIC

.... The Western Union Telegraph Company has 4,642 shareholders, an increase of more than 800 over last year, and the largest number ever upon the books.

.... Governor Pattison, of Pennsylvania, has signed the bill providing for the recovery of damages to trees along public highways by telegraph, telephone and electric light companies.

.... It is said that a Mr. Rudge, of Bath, England, anticipated Mr. Edison in a machine very similar to the kinetograph. Mr. Rudge is able, by some unknown means, to project upon a screen a series of pictures in which continuous action is depicted.

A Novel Electric Bell.

The *Journal des Applications Electriques* describes a novel form of electric bell, in which the vibrations are maintained, not by hammering, but by means of synchronically intermittent electro-magnetic attractions. The bell or gong itself, which is made of steel, carries upon its outer edge a very small plate of platinum; and this plate when the apparatus is at rest, just touches another platinum contact that is attached to a fixed spring. Within the bell, and almost touching its edge, is a short fixed electro-magnet, and this is put into electrical circuit with the platinum contact pieces. Now, when the current is passed, it is obvious that the steel bell will be successively attracted and released with great rapidity; similarly to the contact breaker of a Ruhmkorff coil. The amplitude of its vibrations will, of course, depend upon the strength of the current and upon the adjustment of the spring contact. The bell is so placed as that when in full vibration it does not quite touch the face of the bar magnet. Hence, there is practically nothing to interfere with its vibration; and the disagreeable clashing of the ordinary electric hammer is replaced by a pure musical note. When the bell is mounted in a resonant box, it can be heard distinctly from a long distance, and the arrangement is recommended for adaptation to orchestral music.

World's Fair News.

Official acceptance of the president's invitation to participate in the World's Columbian Exposition at Chicago, has been received from the following foreign governments: France, Great Britain, Germany, Spain, Japan, China, Mexico, Peru, Honduras, Salvador, Costa Rica, Columbia, Cuba, Guatemala and Jamaica.

Unofficial assurance of acceptance has come from Egypt, Morocco, Nicaragua, Venezuela, Ecuador, Brazil, San Domingo, Hayti and British Columbia.

It is reliably reported that the British colonies in the West Indies and South and Central America, including British Honduras, British Guiana, Jamaica, Trinidad, Barbadoes and other islands, will unite in the erection of a "West Indian Court"—a building typical of tropical architecture, and filled with tropical exhibits of most varied and interesting description.

In addition to the information given above, reports have been received at exposition headquarters that great interest concerning the exposition is felt in Austria-Hungary, Belgium, Holland, Norway and Sweden, Russia, India and other countries, and that their participation is almost a certainty.

Many of the foreign nations will erect buildings of their own. But few particulars have been yet received concerning the amounts which foreign nations will expend on their exhibits, but the probability is that they will be larger than for any previous world's fair.

* * The Edison Electric Illuminating Company, of New York, bought 100 "C. & C." fan outfits last week.

* * The Pettingell-Andrews Company has purchased the Standard Electric Supply Company, of Boston.

* * The steamship "City of New York" has been equipped with "C. & C." fan outfits with 18 inch fans.

* * Several nickle-plated "C. & C." fan outfits have recently been installed in the White House at Washington.

Electric street railway companies should feel encouraged by the final decision in the Cincinnati telephone case, which we published last week.

* * An electric railroad, it is announced, is soon to be built from Pasadena, Cal., to the summit of the Sierra Madres Mountains, directly back from the city.

* * A diminutive electric welding machine is used in the Thomson-Houston lamp factory for fusing together the copper and platinum wires in lamp bases.

* * The new operating room in the City Hospital, at Rochester, N. Y., is ventilated by a "C. & C." exhaust electric fan combination, with fan 36 inches in diameter.

* * The Great Western Electrical Supply Company has sued the Novelty Electric Supply Manufacturing Company, Cincinnati, for $17,227.42 on an account due.

* * Electrical cranes are to be used in unloading vessels at Southampton, Eng. The large quantities of mail matter received at this port make it necessary that some expeditious means of handling it be employed.

* * Already the proposed building of the electric road to Haywards has created a stir in property between Fruit Vale and San Leandro. Tracts are being cut up and placed on the market. This is the first show of activity in these holdings in years. —*Oakland, Cal., Tribune.*

* * A new electrical process for the treatment of ores has been devised. The patents are held by the Goudyard Electric Company, composed of St. Louis and Denver capitalists, and funds are being gathered for the purpose of testing their value by the location and operation of works in Denver.

* * It is understood that the Beverly & Danvers, Mass., storage battery road has been turned over to the employés until fall, when the lease expires, to be operated by them on the co-operative plan. They are to meet the running expenses and reserve the balance for themselves. Nine trips will be run daily.

* * The Edison General Electric Company has brought suit against M. H. Sherman and F. V. McDonald to recover $37,000, balance due on an assigned claim of the Sprague Electric and Motor Company, of New York, upon a contract for the electrical equipment of a street railway system in Los Angeles, Cal., F. V. McDonald having guaranteed Sherman's agreement for the acceptance of the work.

Westinghouse Company Sued for Infringement.

A press dispatch from Pittsburgh, dated June 18, says: Suit has been instituted in the United States District Court by the Short Electric Railway Company, of Cleveland, against the Westinghouse Electric and Manufacturing Company, of Pittsburgh, in which the latter is charged with the infringement of patents relating to gearless electric motors.

The "1891" Motor.

In the accompanying engravings is illustrated a new style of motor, controlled by Mr. O. A. Foster, of No. 8 Oliver street, Boston. One of the advantages claimed for this motor is the freedom from liability of injury to the armature, the latter being provided with a simple armature composed of four iron bars without any winding thereon. These bars are clamped between two caps or heads mounted on a central spindle, and revolve in close relation to a series of field magnets arranged circumferentially around the armature, and mounted on two heads which form the supports for the motor. A simple commutator for switching the current into the field magnet spools at the proper time and cutting it off at the proper time is provided. For light work the motor will be found very convenient. By dispensing with the armature winding, increased lightness is secured. The motor may carry currents having a wide range in

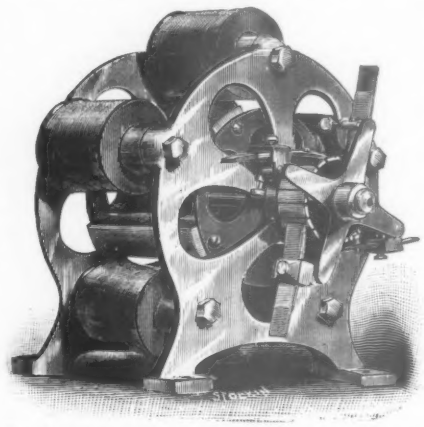


FIG. 2.—VIEW OF LARGE "1891" ELECTRIC MOTOR.

strength, by reason of the absence of an armature winding and, therefore, a freedom from liability of injury under a slow armature movement. The motor may take any speed depending on the strength of current circulating in the field magnet coils. It is, therefore, free from danger of overloading; indeed, it is stated that it may be loaded down to a dead standstill without danger of burning out, and when the load is lightened will start off as light as in the beginning. An important feature, resulting from its simplicity of structure, is the cheapness with which it may be made. Its lightness in weight is also another advantage which will commend it for certain styles of work, such as the running of sewing machines. It is claimed that the motor when built of a proper size will be of great advantage in street car traction, inasmuch as its armature can be connected directly to a driving axle without the intermediation of gearing. It could be started from a state of rest and at slow speed without injury to the winding.

The Jamaica, L. I., Electric Railway.

One of the most successful electric street railroads in the vicinity of New York is the

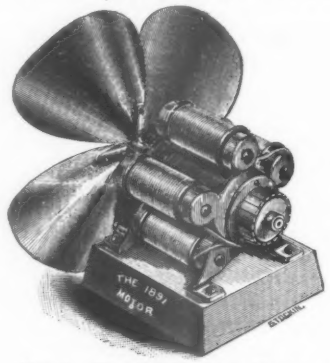


FIG. 1.—THE "1891" FAN MOTOR.

Jamaica and Brooklyn Road, running between East New York and Jamaica, a distance of 6¼ miles. The road is operated by a company of which the following well-known gentlemen are the officers: Samuel Spencer, president; John S. Wright, vice-president; W. S. Townsend, secretary; G. H. Streat, treasurer and Wm. M. Scott, superintendent. To the liberal policy and progressive business methods of these gentlemen is due the present financial standing of the company, as they took hold of it when it was in a very poor condition and on anything but a paying basis.

The road was originally started on January 1, 1888, but the equipment and service was so poor that it met with but small patronage. In June, 1889, the present company bought the entire plant, as well as the turnpike road over which it runs, and immediately commenced a thorough overhauling and by November of the same year the road was in first-class condition.

They have now 12½ miles of single track on an excellent road-bed and laid with 50-pound rails. They have also adopted the Edison system and have two dynamos, one of 80 and the other of 108 horse-power, and so arranged that either one or both can operate the entire plant. The three boilers in use will aggregate 300 horse-power. The rolling stock consists of 20 motors and 2 trail cars and they are run on 15 minutes' headway at an average speed of 12 miles an hour.

The company employ at present about 40 men and carry between 2,800 and 3,000 passengers daily.

The plant is a good one and will probably be enlarged before long, as the company contemplate doing an extensive lighting business, in addition, in the near future.

The Cooke Portable Railway Switch.

Our illustration represents a very novel switch or car replacer, especially designed for replacing derailed horse or electric cars. It is so simple in construction that any one can see at a glance how it is used. The plates or replacers are made of cast iron, a slot or groove being cast in each plate which sets over the rail, an inclined flange or projection coming down and meeting the pavement or road-bed. They are made necessarily right and left and need no bolting or fastening to the tracks whatever. Each casting weighs about 25 pounds. A man can easily pick up and place them, and his car is back on the track with scarcely any loss of time, or if it be a horse car line, without any very hard pulling. This little device will, undoubtedly, soon be a portion of the equipment of every street car. An especial type is made for electric roads.

LITERARY.

"Reports from the Consuls of the United States, for April, 1891," is at hand.

"The Thirty-second Annual Report of the Trustees of the Cooper Union," May 29, 1891, has been received.

The present perturbed state of the republic of Hayti will lend special interest to "An Engineer's Glimpse of Hayti," by Foster Crowell, to appear in the July *Scribner*. The author believes that "Hayti has no enemies outside her borders, except the exiles she has sent away; her worst foe is not the stranger within her gates, but the spirit of

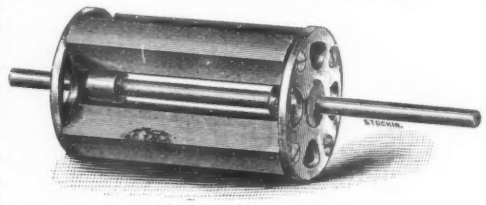


FIG. 3.—ARMATURE.

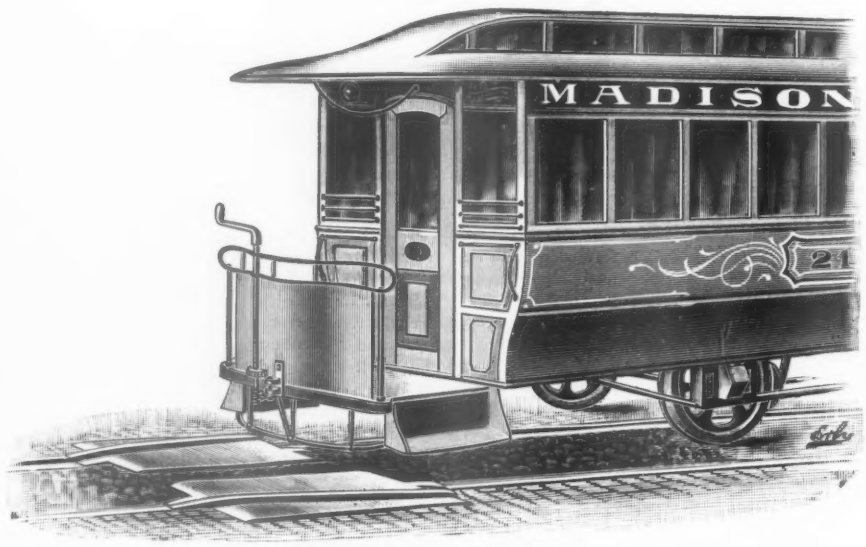
national lawlessness engendered by the menace of her standing army."

"The President of the Farmers' Alliance," Col. L. L. Polk, replies in the July number of the *North American Review* to the article by Col. George E. Waring, Jr., which appeared in the June number. The interests of the farmer are further discussed in the same number by Erastus Wiman, under the caption of "The Farmer on Top." This number also contains "Industrial and Financial Co operation," by the well-known merchant and political economist, F. B. Thurber.

PERSONAL.

The name of Mr. George B. Muldaur now appears as the associate editor of our esteemed contemporary, *The Electrical Engineer*. Mr. Muldaur is a graduate of Stevens' Institute of Technology and an able young man. We wish him success.

Mr. Chas. A. Schieren, of Charles A. Schieren & Co., the well-known manufacturers of patent perforated electric leather belting, has been elected vice-president of the newly organized Hide and Leather National Bank in this city. Mr. Schieren is a very successful and able business man of the highest integrity, and patrons of the new bank may congratulate themselves that so excellent a choice for vice-president has been made.



COOKE'S PORTABLE CAR SWITCH.

RAILWAY TELEGRAPH SUPERINTENDENTS.

(*Continued from page 237.*)

"What is that?"

"I don't know, but I am going to find out."

I went up to the library and found they had a set of "De la Rive," but it was so highly valued that I could not borrow it. I looked it over and found a description of Varley's polarized relay, and the minute I found it I wondered why we didn't know something of it before. Next day we were ready to make it. Our customer's name was Dr. Nicholson. He proposed to have a Varley relay that would respond to a positive, and another that would respond to a negative current, and a neutral relay which would respond to a stronger current and control both sounders. He constructed an alphabet also. He had figured it out that a dash took as long to make as a "p." By his system, for instance, a tick on one sounder and a flap on the other would mean "b." It was put in operation between Cincinnati and Maysville, Ky., and business was transmitted by it. Dr. Nicholson was a very ingenious man. In 1858 he ran a skiff across the Ohio River with an electric motor. He took his telegraph apparatus to New York, and was told that it would not work, that the positive and negative plan was all right, but that the stronger current he proposed would not answer the purpose. At that time a duplex was working between Cincinnati and Louisville, and frequently the business was all piled up at one end. We thought that by using the doctor's device the capacity of the wire could be doubled in either direction. It never occurred to me that if we could do this, we could, by introducing a differential relay, produce a quadruplex. I said to the doctor, "Have you got any money?" He said that he was pretty well cleaned out up at the farm and had nothing left but a cow. I told him to go and sell his cow, for I believed he had got four for one. The doctor went to Washington after his patent and made a contract with the Western Union, and his device was tried between Chicago and Cincinnati, but it was not a success. Shortly after that the quadruplex was brought out through the efforts of Edison and Prescott, and with the resources of the Western Union Company. I do not think the doctor would have accomplished this result, as he was imbued with the idea of shortening the alphabet. His claim was subsequently recognized by the Western Union Company, and he received a suitable compensation for his invention.

Order Signal, which was very favorably commented upon. This signal is the invention of Mr. Robert Stewart, superintendent of telegraph of the Central R. R. of New Jersey, and has been fully described in our columns.

The necessity of an individual call has long been appreciated by all who are engaged in railway telegraphy, and this want has now been provided for. Two working systems were shown, embodying similar principles, one by the Gill-Alexander Electric Manufacturing Company, of Kansas City, Mo., represented by Mr. Gill, and the other that of the Electric Secret Service Company, of New York city, represented by Mr. S. S. Bogart and Mr. Mackie. The latter system differs from the Gill-Alexander, in the use of an automatic transmitter. The insertion of one of any number of special plugs enables the calling office to secure the attention of any desired distant station by the ringing of a vibrating bell. In the Gill system the regular Morse key is used for sending the required combination, which is an exceedingly simple operation.

The Union Switch and Signal Company exhibited a revolving signal showing danger and safety by signals, shown by semaphores, which are now generally recognized as being the most satisfactory.

The Edison phonoplex system was shown in actual operation over a Chesapeake and Ohio wire. In conjunction with it, various types of the Edison-Lalande battery was shown, also condensers manufactured by Wm. Marshall.

A working sample of O'Neil's automatic highway crossing alarm was shown by A. L. Dunbar, general agent, also a signal for the same purpose invented by E. M. Chase.

I. N. Miller of Cincinnati, showed a sample of his protector for telephone and telegraph instruments, against lightning and heavy currents, and W. P. Ward a working set of a very simple repeater.

Dennison's automatic telegraph was the most interesting exhibit at the meeting. It reproduced, in *fac-simile*, drawings, autographs, etc., in a very perfect manner, transmitting and receiving being effected by rapidly vibrating arms across the metallic tape at one end and the chemically prepared paper at the other. A similar but more perfect reproduction was obtained by use of an embossed slip.

OUR ST. LOUIS LETTER.

A New Electric Line is to be built from Bloomington, Ill., to Normal. The company is incorporated for $250,000, and is

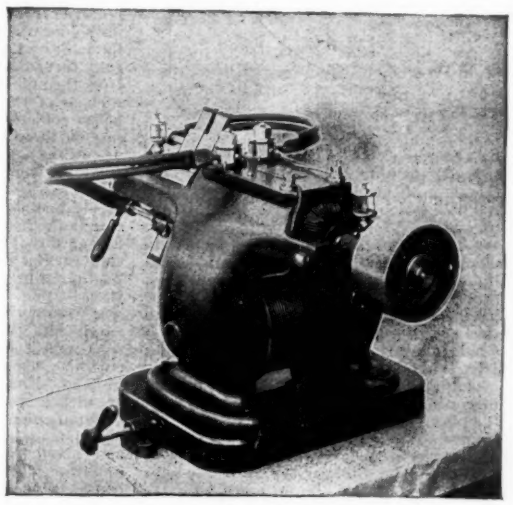


FIG. 1.—COLBURN 300-LIGHT DYNAMO.

Resolutions of thanks were passed to the various companies and individuals who had aided in making the meeting a very pleasant one. None were more heartily endorsed than that which acknowledged the courtesy of the Cincinnati Electric Light Company, in providing an electric motor fan for the meeting room, which made it one of the most comfortable spots in the city.

At 5:30 P. M. the meeting adjourned.

EXHIBITS.

Thursday at 10 A. M. the Association visited and inspected officially the various exhibits of electrical apparatus.

The Hall Signal Company exhibited a working sample of the Stewart-Hall Train

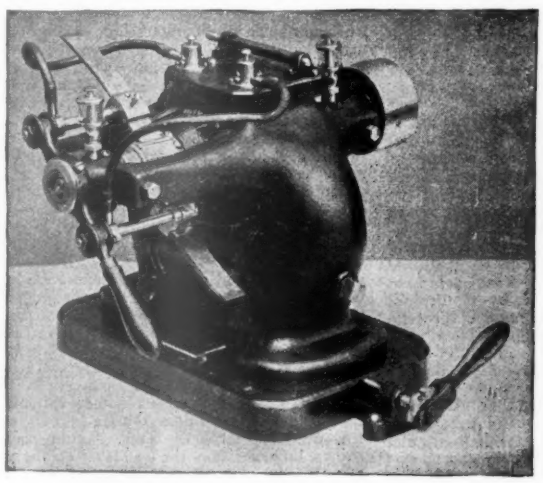


FIG. 2.—COLBURN DEPOSITING MACHINE.

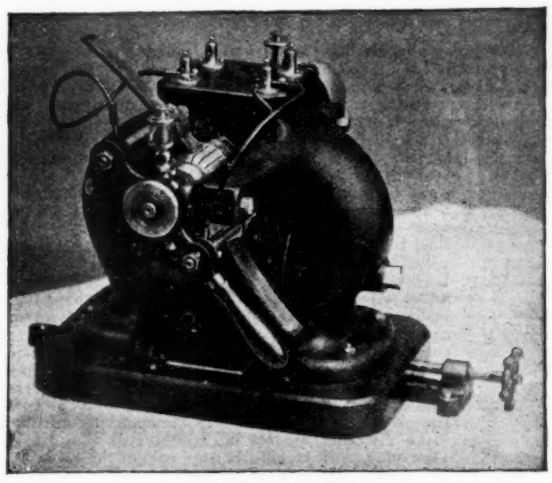


FIG. 3—COLBURN ONE HORSE-POWER CONSTANT POTENTIAL MOTOR.

under the auspices of the Bloomington Fair Association.

The Recent Storms have done no small damage to the electric light, telephone and telegraph wires, and in one instance brought down even the South Sixth street electric line's overhead wire.

The Emerson Electric Company are having a fine run of business. They have been obliged to enlarge their plant and are now running night and day to fill orders. They are looking for larger quarters and expect in a month or two to move into a building which will give them plenty of room for building.

A Novelty which is taking well with the public, is the system of electric overhead fans, such as are suitable for dining rooms, as gotten out by Mr. Wolfram. Mr. Wolfram is now placing these fans in all the large restaurants of the city. For office use, the St. Louis Electrical Supply Company have some very neat fans which can be connected with the alternating current in use here.

Now that the location of the new Union Depot is decided on, several parties have had bills introduced into the city council asking for a right of way for an electric line on the Eighteenth street bridge. As the bridge leads directly into the depot, it is a very desirable route for a crosstown road. It is also safe to say that if a franchise is obtained, that some of the present roads will bid high to get it.

In a Few Days the Adams Electric Company begins its suit against the Lindell Railway Company, of this city. The Lindell Railway uses the Sprague system, so that the suit is virtually against that company. The company claims that the Sprague patents were the first used and hence were the first infringement of their patents. As yet no action has been taken by the Lindell Company, but it is expected that the Sprague Company will have its representatives carry on the trial for the railway company.

St. Louis, June 18, 1891. W. H. B.

Colburn Motors and Dynamos.

Our illustrations on this page show three examples of the motors and dynamos manufactured by the Colburn Electric Manufacturing Company, Fitchburg, Mass. In Fig. 1 is shown a 300-light dynamo, in Fig. 2 a depositing machine for electroplaters' use, and in Fig. 3 a one horse-power constant potential motor. In the construction of these machines wrought iron cores cast solid on one end and on a taper on the other, thus obtaining perfect magnetic contact, are used. The magnetic spools are wound upon bobbins. Separate composition bushings are used for boxes, and the bearing of the large size machines are made of the best steel. Automatic oil feed cups are used on all the bearings. The armature is thoroughly laminated and balanced before and after winding. The commutator, made of tempered copper, is separate from the shaft and made upon a steel tube that is easily detached. Other advantages of these machines are short magnetic field, direct poles, thorough construction, of best materials, the design pleasing to the eye, and good mechanically and electrically.

ELECTRIC LIGHT NEWS

—— Portland, Me., will have a board of electrical control.

—— The Edison Sault Electric Light & Power Company, at Sault Ste. Marie, is said to have defaulted on a mortgage indebtedness of $30,000 and foreclosure proceedings have been commenced.

—— George B. Johnson, president of the Hastings Electric Light Company, is in jail at Hastings, Ia., for contempt of court in not answering questions on the witness stand. He says he will go to the penitentiary before he will answer.

—— M. J. Francisco & Son and the Rutland Electric Light Company have just moved into elegant new offices in the *Herald* Building, Rutland, Vt. This company, under Mr. Francisco's management, is one of the most successful in the country.

—— The United States Electric Lighting Company, of Washington, is to have an addition to its central station, which will be one story high, 103x120 feet, and will cost $25,000. This will make the building about twice its present size, and it is the intention of the company to add to its plant from time to time such machines as are needed.

—— The National Theatre building, Washington, is to be wired for about 650 electric lights, which will be distributed through the auditorium, stage, lobby, halls and office rooms of the building. The footlights are to be arranged in three circuits of different colored lights, and each circuit is to be independent of the others.

—— Judgment for $142,802 was entered, June 11, against the Harlem Lighting Company, of Eightieth street and Avenue B, New York, in favor of the Manhattan Electric Light Company, Limited, for materials furnished and money loaned between August 27, 1888, and March 31, 1891. Both concerns occupy the same buildings and are very closely connected, Abram C. Bernheim being the secretary of both companies. The Harlem Lighting Company was incorporated November 4, 1886, with a capital stock of $100,000, which was afterward increased to $250,000. The annual report, filed January 13 last, said the debts did not exceed $188,000. Lewis Gotthold was the president.

—— The suit of James A. Renshaw *vs.* Louisiana Electric Light Company was decided by Judge King, at New Orleans, June 9, in favor of the defendant company. Plaintiff, as a citizen and taxpayer, held that public money had been misapplied, and sued to annul the contract for lighting between the defendant and the city of New Orleans. It was charged that the company conspired with the Southwestern Brush Electric Light Company and formed a pool whereby the Louisiana Company obtained the electric lighting contract, it being expressly stipulated in the specifications that such arrangement would cause the annulment of the contract. An exception of no cause of action was filed by defendant, which the court maintained, holding that plaintiff not having alleged that the City Council was actuated by fraud, cannot compel them to sue for a dissolution or declare the contract at an end, and the court will not interfere with the legal discretion which the sovereign, the State and the people have vested in the city and its officers.

A Large Order.

Mr. Hood, of Chicago, has just taken a contract for the largest number of secondary batteries ever sold at one time. The order was from Mr. Hill, of St. Paul, Minn., and was for 600 "15L" accumulator cells. They will be used to supply current for an isolated lighting plant.

A Thermo-Electric Method of Studying Cylinder Condensation in Steam Engine Cylinders.

READ BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, NEW YORK, MAY 20, 1891, BY PROF. EDWIN H. HALL.

The subject of cylinder condensation is one that possibly would come more aptly before the mechanical engineers than before the electrical engineers, and yet most electrical engineers are to a greater or less extent mechanical engineers, and the time seems not yet to be near when we can dispense with the steam engine in the practical applications of electricity. The methods for turning the energy of coal directly into electric currents, I believe have not yet been put into application. The subject of cylinder condensation is one that has always been prominent in the study of the steam engine. Before the time of James Watt, as you are all aware, at every stroke the cylinder was filled with steam, and then it was cooled down by pouring water on the outside, or by admitting water into the inside, so that whenever the steam was admitted it found the cylinder cool. A large part of the steam admitted at every stroke was turned into water at once on admission, and some of it was doubtless turned back into steam during the stroke, but much of it went out as water in the end. Watt introduced the independent condenser, by means of which the steam is removed from the cylinder without cooling the latter down, as it was cooled before; and yet, it is still believed that a very considerable part of all the steam that enters the cylinder is condensed upon the inner surface of the cylinder; that some of this is re-evaporated during the stroke, but that a very considerable part remains as liquid at the end of the forward stroke and is only turned back into steam during the back stroke, when it is a disadvantage rather than an advantage, for it has to be expelled by the returning piston. It is considered that in some engines as much as 25 per cent. of all the steam that enters the cylinder goes through the cylinder as water—that is, during the forward part of the stroke. Writers upon steam engineering have devoted a good deal of attention to the discussion of the cause of cylinder condensation, with perhaps less attention to suggestions for remedy. The cause of cylinder condensation is this, that when the cylinder is thrown into communication with the condenser, rapid evaporation takes place of the water remaining on the wall, and that rapid evaporation under the diminished pressure cools greatly the cylinder wall. A little more than two years ago (January 17, 1889), Mr. Dickerson, of New York, gave an address before the Electric Club, of New York, I think, in which he advanced the proposition that the peculiar character of the indicator card of a steam engine which was supposed to show cylinder condensation and re-evaporation was due to leakage by the valves—leakage in by the valves at one part of the stroke, leakage out by the valves at another part of the stroke. He made the statement that the steamers in the waters about New York city would travel four or five miles an hour with the valve between the boiler and the cylinder closed. I do not know how accurate that statement was. I have never seen any statement in contradiction of it. Mr. Dickerson's paper excited my interest—perhaps more than it would have excited my interest if I had been a trained steam engineer. I know that this was a matter in controversy between steam engineers—that they were

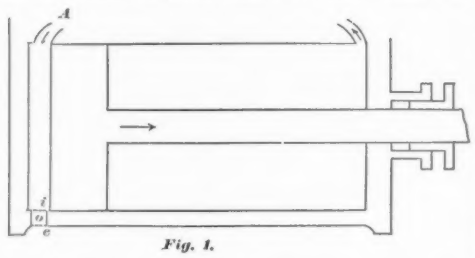


Fig. 1.

by no means at one as to the amount of cylinder condensation, and by no means in agreement as to what caused the cylinder condensation, some believing that the steam coming in here at A (Fig. 1) was cooled by contact with a layer of water remaining over from the previous stroke—the layer of water upon the inside of the cylinder. They thought that you could hardly account by the action of the iron alone for the very sudden condensation of the large amount of steam that is condensed. Mr. Dickerson's paper, then, stimulated me to undertake an investigation of this matter in a direction in which it had not been approached before, so far as I know. Steam engineers have invariably, so far as I know, examined this question by study of the indicator card, examining the pressure at different parts of the stroke—the pressure and volume, and finding out how much steam they indicate. Knowing the pressure at this part of the stroke, C (Fig. 2), and the volume occupied by the steam, we can tell what weight of steam there is in the cylinder as *steam*. It is found frequently that there is more steam in the cylinder at the end of the stroke than at the beginning of the expansion. According to Mr. Dickerson, that was due to the leakage by the valves by which steam was admitted, when the pressure in the cylinder fell low. It seemed to me that we might test the question how much heat enters the cylinder wall

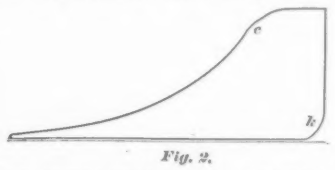


Fig. 2.

by a thermo-electric method. Let this, *i. e.* (Fig. 1) (making a sketch), represent the thickness of the cylinder wall. Now, this 0 is a hole which in the engine which I have used is bored for attaching the indicator. It is a hole about three quarters of an inch in diameter. The thickness of the wall is about three-quarters of an inch—a little more than that—I screwed into that hole a plug (Fig. 3) having at this end, *i*, a slice of iron—I had steel at first—of known thickness. Here is a hole going through the plug to that slice. Here is another. Into that hole I put a bar of antimony A; into this hole a bar of bismuth, B. The two were insulated from the plug. It is known to all of you that bismuth and antimony make an excellent thermo-electric pair—the best that is in practical use. If I connect the antimony with the copper wire *g*—the bismuth with the copper wire *c*, and lead those wires to a galvanometer, I shall get a current through that galvanometer whenever the two junctions here, *a* and *b*, are at a different temperature from the section where the antimony and the bismuth strike this slice of iron. If I put the ends of these rods of bismuth and antimony into a pot of paraffine and heat that paraffine, when I get the temperature of these two junctions *a* and *b*, where the copper joins the bismuth and antimony, the same as the temperature where the antimony and bis-

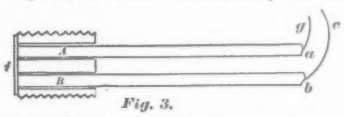


Fig. 3.

muth strikes the iron, the current will cease. If the temperature here is below the temperature there, I get the current in one direction. If the temperature here is higher than the temperature there, I get a current in the opposite direction. That was the beginning of the method. But it presently occurred to me that it would not do to use bismuth and antimony, for the reason that the heat conductivity of those substances is too different from that of iron. My purpose was to find what the temperature was at a certain thickness in the cylinder wall at a certain part of the stroke. (I close this circuit, *g c*, at a particular part of the stroke by means of a cam upon the crank. I can close the circuit at any part of the stroke for a short time.)*

It being my purpose, I say, to find what the temperature is at a particular depth in the iron, I wished to have that temperature as exactly as possible what it would be if this iron were in a normal condition, that is, if this were in a solid cylinder, instead of being in a prepared plug. To get that I found it necessary to have for these bars, A and B (Fig. 3), a heat conductivity which was more nearly like that of iron than the heat conductivity of antimony and bismuth is. So I cast about for some metal which would *with iron itself* make a good thermo electric couple, and of which the heat conductivity would be very like that of iron. Nickel suggested itself. Nickel and iron make a very good thermo-electric pair. I determined to make my plug in this way. Here (Fig. 4) is a plug with a hole bored completely through it. Here is a slice of cast iron S, ground to a particular thickness, which is screwed on at the end of the plug, making a steam tight joint made—at least, I meant it to be steam tight.†

Into this hole I put a core of nickel insulated from the iron, except here, where it strikes the slice. The nickel is soldered to the iron in this way. The slice is *tinned* very thinly, the end of the nickel core is also tinned. The two are heated very hot, and then in a vise they are held together until they are cooled, so that the thickness of the solder there is not more than a thousandth of an inch. The soldering was done with the slice and the nickel core in place, the slice being screwed to the plug, and the core being surrounded with a single layer of paper to keep it free from the iron, except at the bottom of the hole. Slice and core were removed from the plug after soldering, and the solder which had been squeezed out from the joint by the action of the vise was carefully turned off in a lathe. The distance from the outer end of the core to the farther surface of the slice was measured carefully before soldering and after soldering. In no case did these measurements show the thickness of the solder to be as much as .02 m.

I know very definitely, then, the depth at which the contact takes place. Now, as to the heat conductivity of nickel, I can find no data in the books. I believe no information in regard to it turned up in my studies. But I know from the relation of its electric conductivity to that of iron that the heat conductivity ought to be nearly like that of iron, for usually heat conductivity and electric conductivity go hand in hand. I had to have a bar of nickel made to make the determination. I had a bar of nickel made about a yard long and about one square inch in cross section, and I had considerable trouble to get it. I determined the heat conductivity of that by comparison with a similar bar of cast iron. I found that the heat conductivity of nickel is rather less than that of cast iron, perhaps, 15 or 20 per cent. less.* but still nearer the heat conductivity of cast iron than any other metal that I could get that would make with iron a good thermo-electric junction. The specific heat of nickel is near that of iron, which again is as important, perhaps, as the matter of the thermal conductivity. Now, from the nickel core I lead a nickel wire, both being made from the same bar of which I had determined the conductivity; from the iron, an iron wire. This and the one of nickel were slender bars about 15 cm. long, rather than wires proper. These are not drawn to scale. These junctions *i* and *n* (Fig. 4) are put in a pot of paraffine and I go through the processes which I have indicated already.

I had three plugs like this made. With one the slice of iron was half a millimeter thick (.051 cm.), with the other a millimeter thick (0.101 cm.), with the other two millimeters thick (0.203 cm.). Let this, Fig. 2, be the indicator card from the engine with which we are making this test. I used first the plug with the thinnest slice, and I found the temperature at this depth of iron, half a millimeter, at that part of the stroke, *k* (Fig. 2), just before steam is admitted. I did the same with the millimeter slice and with the two millimeter slice. Let this line D (Fig. 5) represent 4 mm. of the thickness of the cylinder wall, points at depths of ½ mm., 1 mm. and 2 mm., being marked upon it. Now, I plot a curve. (Let me say that a part of this is prophetic; this curve I haven't been able to plot perfectly.) Suppose that distances out here to the left from the line D represent excesses above 109 degrees—109 degrees centigrade being the temperature of the outer surface of the cylinder wall. With the half millimeter slice at this part of the stroke, *k* (Fig. 2), I find an excess above 109 degrees of eight or nine, which I will represent by distance *a*. With the millimeter slice I find the temperature to be greater at this part of the stroke, and I will represent the excess above 109 degrees by the distance *b*. With the two millimeter slice the temperature was not very different from what it was with the one millimeter. Through the tops of the lines *a*, *b* and *c* I draw a curve. (What I wish to do some time is to be able to plot a curve like that, giving the temperature all the way down here inside the wall of the cylinder at this particular part of the stroke.)

I make similar determinations for that

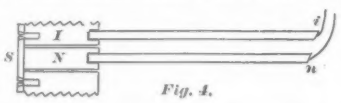


Fig. 4.

part of the stroke, *c* (Fig. 2). I find the temperature at half a millimeter depth has risen to 131 degrees, more or less. The temperature at a depth of a millimeter is a little higher. This point, one-half millimeter deep, has already begun to cool. The fact is that in my engine the cut-off is like that (Fig. 2), pretty gradual, so that re-evaporation very likely begins before cut-off is complete. I suspect, however, that 131 degrees is too low for the temperature at a depth of one-half millimeter. At the depth of two millimeters the temperature is not as high as it is at a depth of one millimeter. At the depth of two millimeters in the iron there is, however, a jump of some four or five degrees centigrade.

One of these curves (Fig. 5) represents the condition of things at this part of the stroke, *k*. The other curve represents the condition of things at that part of the stroke, *c*. The curves are by no means accurate and they are very incomplete, but supposing them made perfect, I have merely to put on here a planimeter to measure the area between those two curves, and it is then easy to determine how much the heat in the cylinder at this part, *c*, of the stroke exceeds the heat in the cylinder at that part, *k*, of the stroke, and this excess of heat is the heat which has been given up by the steam to the cylinder wall, which has been done during the admission. Allowance should be made, of course, for the loss through the wall meanwhile. Then I compare that with the indicator card and see whether the two are in agreement.

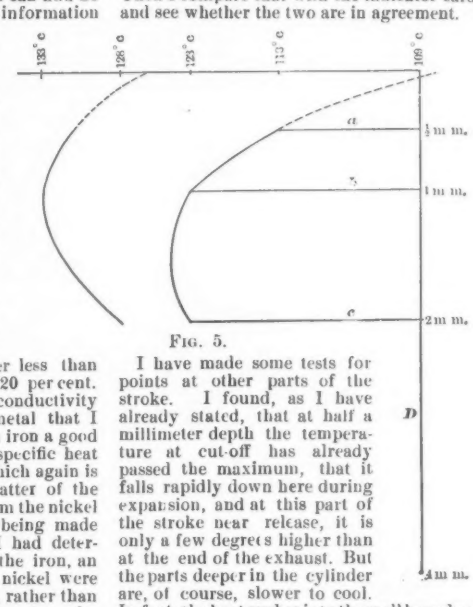


FIG. 5.

I have made some tests for points at other parts of the stroke. I found, as I have already stated, that at half a millimeter depth the temperature at cut-off has already passed the maximum, that it falls rapidly down here during expansion, and at this part of the stroke near release, it is only a few degrees higher than at the end of the exhaust. But the parts deeper in the cylinder are, of course, slower to cool. In fact, the heat rushes into the wall here during admission; then, as soon as the pressure is relieved, the water begins to evaporate from the inner wall here and the heat ebbs back and is spent, some part of it, in forming steam during the expansion, but not all of it; a considerable part remains at the end of the stroke, to be spent in evaporating water which is still clinging to the wall of the cylinder. As I have said, this research is by no means complete, but it has gone far enough to indicate that a very large quantity of heat goes into the cylinder wall. A very rough calculation from my experiments indicates that in the engine I am using (Kendall & Roberts 10 inch cylinder with 15-inch stroke) this maximum pressure I get here, Fig. 2, is about 33 pounds above atmospheric, and I use an expansion of about four—not quite that, about three and one quarter—and about 60 strokes to the minute. According to the best estimate I can make, probably two-thirds as much steam is condensed upon the cylinder wall as remains active at the beginning of expansion. I should say that two-fifths (this is very likely an over-estimate, perhaps one-third would be safer), probably, of all the steam that enters that cylinder is condensed upon the cylinder wall upon the first quarter of the stroke. How much of that is re-evaporated during the stroke, and so helps more or less, I do not yet know. According to the indicator cards taken during the experiments with the plugs, the weight of steam in the cylinder at the end of expansion is about 1.25 times as great as just after cut off. How much heat is absorbed by the layer of water which remains over from the previous stroke I cannot tell. I think there is some evidence that a layer of water does remain over from the previous stroke. This examination shows, however, that the iron is exceedingly effective in cylinder condensation, and it suggests the question whether it is not possible to coat the inner wall of the engine with something which would prevent, to a considerable extent, this condensation. It is not easy to find something with which one can coat the rubbing surfaces of the cylinder, I suppose, but there is the end of the cylinder and there is the face of the piston, and those two surfaces make, in the case of a short cut-off, perhaps more than half the area which is effective in this cylinder condensation. It doesn't seem to me at all impossible that some comparatively non-conducting material can be found with which those surfaces can be coated so as very materially to decrease the cylinder condensation. Experiments for that purpose could easily be made with plugs of this kind. Instead of having to coat the whole cylinder,

*In my latest experiments the fly-wheel has made about 60 revolutions per minute, and contact has lasted about one-sixtieth part of a revolution. The cam pushes two pieces of brass together without touching either of them directly. Springs hold the two slips of brass apart when the cam is not acting.

†In some of the experiments this joint was not perfectly tight, for *water* was sometimes seen to come out by the *core* N before the plug became hot. Generally upon such occasions the leaking appeared to cease when the plug became hot. The fact probably is that the joint continued to leak slightly, but leaked *dry* steam, the temperature at the outer end of the plug being about 109° C, and at the inner end considerably higher. Both experiment and reason indicate that the effect of such leakage upon the temperature found was slight.

* The nickel used was of fair commercial quality. I am not yet prepared to publish details of the measurement of its conductivity.

one might lay on this plug some non-conducting material and see how much difference that would make in the amount of heat absorbed. I haven't attempted anything of the kind, but it doesn't seem fanciful to imagine that something valuable might come out of it, and a very large saving in the steam used in steam engines might, perhaps, be made in this way.

The research of which I have here given an account has been carried on with money from the Rumford Fund of the American Academy of Arts and Sciences.

For indispensable assistance in the investigation I am indebted to Messrs. Barron, Curtis, Hale, Kendrick and Page, members of a class at Harvard College, engaged in a study of the steam engine.

DISCUSSION.

Dr. W. E. Geyer: I know of some experiments where an attempt was made to effect that saving of which Professor Hall speaks by using bismuth in parts of the cylinder. Bismuth is a metal having an extremely low conductivity of heat, and its specific heat is also extremely low. Under the circumstances, bismuth would not stand; it would gradually grind away, or be torn to pieces and would clog all the apparatus.

Professor Nichols: I am not capable of discussing this paper from the standpoint of the steam engineer, but from the point of view of applied physics it is an exceedingly interesting paper, both on account of the line of work and the method employed, and on account of the light which this method seems to throw upon the problem of heat in metallic walls. I would like to ask Professor Hall whether in his opinion something like lag is to be looked for in the performance of a thermopile on this method. Of course, this thermopile is subjected to rather rapid changes of temperature at its junction. To what extent must its sluggishness be taken into account in interpreting the indications of the galvanometer, or does not that enter at all? I have often thought that this must be a factor which we should take into account in attempting to measure fleeting heat values at the junction of any thermopile. I have never looked into it with detail.

Professor Hall: As the thermopile is ordinarily constructed, there would be decidedly a lag. A thermopile is ordinarily constructed in this way: There is one bar of antimony; here is the bismuth, and the two are soldered together for an indefinite distance. If you apply heat to the ends you do not know what you get; that is, if it is a fleeting thing, as you say. But you see what I have. I know what my junction is. There is a definite surface of contact, save for the very thin layer of solder already mentioned. When the heat strikes that I do not see how there can be any lag.

The Chairman (Vice-President Hammer): Would any advantage come from the electrical welding of the contacts there?

Professor Hall: No, I do not think there would. I think electrical welding would make the thickness of the iron uncertain somewhat; I suppose the pressure you would have to apply might change it somewhat. I have a plug which I propose to try which shall not be soldered—the nickel core being simply held by pressure against the iron slice—to see what difference I shall get between this plug and the others. I haven't tried it.

Mr. George G. Grower: I would like to ask if it would not take an appreciable time for the heat to penetrate a depth of metal of half a millimeter, a millimeter, or two millimeters. I should think there would be an appreciable interval of time of penetrating that depth of metal, so that instead of getting the temperature at the portion of the stroke expected, it might be at an advanced portion of it.

Professor Hall: What I want to know is not the temperature there at the inner surface, but the temperature here at my junction. The lag (in one sense) is the very thing I am investigating. I test that for different depths. If I know what the temperature is here at a certain depth at one part of the stroke, and what the temperature is at the same depth at another part of the stroke—if I can tell how much heat has gone into the iron between one part of the stroke and another part of the stroke, that is all I want.

Adams Brings Suit.

The Lindell Railway Company, of St. Louis, were sued June 12 by the Adams Electric Company, for alleged infringements upon the Adams' electric railway motor. The substance of the claim made by Dr. Adams is that he holds letters patent for the only practical method by which electricity can be applied to street cars or other motive purposes. The court is asked to grant a preliminary and a permanent writ of injunction, strictly enjoining the Lindell Company from making or using motors that employ the principles embodied in the motor for which Dr. Adams holds letters patent.

This is another case of an outsider against the field.

Discussion of Dr. W. H. Wahl's Paper on "The Future of the Aluminium Problem from a Chemical Standpoint."

Professor Thomson: There is a source of heat, it occurred to me during the reading of the paper, which has been neglected and which might probably be turned to account in this direction, and that is the mere concentration of the sun's heat by large mirrors or lenses. The temperature is, of course, almost that of the sun itself and will certainly fuse aluminium, and we will get it at simply the cost of the use of the apparatus on a sunny day. It is simply an idea which occurs and which may, of course, be shown to be fallacious, but at the same time I can imagine an enormously large lens or mirror which brings its rays to a focus at the bottom, as it were, of a deep crucible, and have our material there subjected to that cheapest heat of the sun from which all our heat is derived through a series of changes which involve great losses.

The Chairman (Prof. F. B. Crocker): In connection with that I happen myself to have heard of such a process. A gentleman told me he was building an apparatus. I do not know how far he has got, or whether he has attained any results. There is no doubt about the possibilities of high temperature and there is no doubt about the cheapness. I think myself that there is absolutely no question about the possibility of reducing aluminium by carbon, provided you have the temperature. I think the argument that carbon has sufficient chemical affinity to draw oxygen away from the aluminium is fallacious, because, in the first place, as Dr. Wahl says, the Cowles process is a proof that sufficient temperature will reduce aluminium, because I do not consider that the action there is electrolytic at all. In the second place, carbon can reduce sodium and potassium, which, if anything, are higher or almost as high in their affinities, as aluminium. It is simply a question of temperature or condition. Carbon has a peculiar property of apparently developing high chemical affinity at high temperatures. The higher the temperature the more it developes a tremendous chemical affinity for oxygen. And it seems to go up directly with the temperature. I do not believe it is unlimited but it will go up sufficiently high, I think, to reduce alumina to a metallic state. If temperature and carbon are all that are needed, the sun and ordinary carbonaceous material will make certainly a very cheap process for reducing that metal. But the production of that temperature by anything but electrical methods or the sun's heat seems to me discouraging. No metallurgical temperatures reach at all near that, nor is there any likelihood of their reaching it. Regenerating furnaces produce very high temperatures but not high enough for that purpose. It is not impossible. Of course, the principle of regenerating furnaces would apparently allow us to reach very high temperatures, but I doubt if they would work very well, and I should think very high temperatures would possibly be obtained by electrical heating.

Dr. Wahl: In connection with this portion of the discussion, I desire to say, simply that, while I have no doubt that the reaction in the Cowles furnace is to some extent an electrolytic action, yet I am of the opinion that it is probably what I have described it to be, and what I believe it is generally accepted to be—a condition of a reduction by the excessive heat which can be produced in the furnace—purely a chemical reaction affected by the enormous heat of the electric arc, the enormous heat rather caused by the passage of the current through this resisting material. But what actually takes place in the Cowles furnace or in the Heroult furnace is difficult to see. I would not desire to have myself quoted as making any positive statement. Conditions are exceedingly curious. We may possibly interrupt the operation midway and find one state of things, and keep on and stop at another stage of the operation and see something else. It is probably partly electrolytic and partly chemical. As to the possibility of obtaining a sufficiently high temperature directly, without the aid of electric heating, I think that it is impossible.

Dr. Leonard Waldo: Aluminium is a material of structural engineering, and the conditions of its work must conform to those ideas which belong to the shop and seldom belong to the laboratory.

Aluminium, as you quite well know, probably has a conductivity equal to copper, bulk for bulk, and it has 2½ or three times the conductivity of copper, weight for weight. I am speaking now of aluminium which is free from silicon and from iron. *A priori*, therefore, it is the best known metal for alloying with copper in order to give copper the structural strength necessary for all forms of electrical engineering. But here the impurities of silicon and iron come in with a particularly damaging effect. The conductivity of the alloys of aluminium and copper as ordinarily made bear no relation whatever to the proportional bulk of the metals themselves. I cannot say much on this question, because it is a question which is being very carefully investigated in our own laboratory. But that is true, and until the producers of aluminium bring the aluminium product over 98, 99 or 99.9—the nearer they can come to it—the electrical engineers have got to be content with quite a low order of conductivity, both in all sorts of places where metal is applied and in their wires where they want strength, and expect to get the conductivity, but fail. The present position of the aluminium bronze is very closely akin to the early years of steel. I heard a question asked of a famous chemist as to whether he could determine the carbon in steel. He said: "Do you really mean that?" "I do," was the answer. The chemist said: "I cannot." Now, the analysis of copper is in its infancy. I doubt whether a man could rely on the determination of copper. But the moment you add aluminium and silicon to copper the question is immensely complicated. The first real work, therefore—now that we have a reasonably pure supply of aluminium, or that we can expect to get a reasonably pure supply of aluminium—is to be done on the scientific side of the question. We have got to have accurate methods of analysis, and we have got to have a great deal of work done on the mixture of copper and pure aluminium, and of aluminium as we get it chemically united with silicon and with iron. The color of the bronze is a royal color. It is merely dipped in nitric acid to get out all the color, and you will get an idea from dipping it what the strength and general value of the metal is.

The Chairman: In regard to the conductivity of an alloy, I should doubt very much if the average conductivity of its constituents, or any approximation to it, could be expected. For example, pure silver put into copper will very seriously interfere with the conductivity, and pure silver is supposed to be better than copper in conductivity. That seems to be a fatal fact about the conductivity of alloys, that any alloying seems to reduce conductivity very seriously, and the smallest percentage of alloy or impurity—whatever you might call it—has a very great effect upon a reduction in conductivity; and this seems to be true, no matter what metals are put together.

Dr. Waldo: Of course, in discussing all these alloys, the best conception to have is that the alloy is a glass rod transparent to electricity. The oxides and other things which come in, and which are precipitated and act as chemical stains, stop the flow of the current, and whether or not the pure aluminium and the pure copper obey that law of disproportionate conductivity is a question which I think no man can pronounce on, because I do not think any man has ever tried it. A great many people have mixed the aluminium and copper and determined the conductivity of the result, but that is a very different thing.

The Chairman: If it is a fact that aluminium bronze or alloys of aluminium and copper or other metals can be made having a conductivity approximating the mean of their constituents, it would certainly be a valuable thing in electrical engineering—a thing greatly to be hoped for.

Mr. Weston: I have used aluminium quite extensively. I think Dr. Waldo is mistaken about its conductivity. I have found it to be 60 per cent. that of copper. There is very little variation in the various samples I have met with, and that is about the average figure. Of course, I think what Dr. Waldo says about the action of small quantities of silicon or iron in aluminium when mixed with copper to form an alloy may have a very marked influence upon the conductivity and working of the alloy. Silicon has a very marked influence on the working qualities of steel and, I think, also on the conductivity. There is another matter there that probably might be worthy of investigation, it appears to me. The copper of commerce is commonly assumed to be extremely pure, and within the past few years there has been a quality of copper called tempered copper put on the market, which analysis shows to be substantially the same as good Lake Superior copper. But when you examine it for conductivity, it has about 60 or 75 per cent. of the conductivity of good Lake Superior copper. Now, it has occurred to me that the tempered copper, which is produced by a secret process, so far as I know, is probably a mixture of copper and hydride of copper, which was discovered by Wurtz some few years ago, and is nearly as brittle as glass. A very small percentage of that hydride of copper added to copper would have a very marked influence, I should think, on the physical and electrical properties of copper. An analyist, unless he made a very careful examination of the copper, would be likely to miss such a thing as a small quantity of hydrogen or hydride of copper, and hence the published analysis of this tempered copper, of which we have heard a great deal, have not been made, probably, with sufficient care to detect a minute trace of hydrogen or hydride. That is a field probably well worth exploring to find whether the hydride of copper, which is very probably formed in making copper, does not come into play here, both in the working properties and in the resistance of the alloys or of the metal itself.

Dr. Waldo: I would like to say that my own best determination of the conductivity of the best aluminium I could get was .6604, but I never have seen a piece of aluminium which was higher than .9903. I have had a number of samples submitted to me which by perfectly easy analysis have run as high as .9975 and .9908. But a rigorous analysis has always reduced the amount of the purity of the aluminium. I doubt extremely whether any ordinary samples of aluminium which you would handle would run to .99. My personal judgment is that the conductivity might run very close to that of copper itself, and there has been no evidence on record that I know of which would tend to disprove that, and a good deal of our private work in our laboratory would go to show it.

Large Sales of Thomson-Houston Apparatus.

The Thomson-Houston Electric Company, Boston, report the following recent sales of apparatus:

ARC APPARATUS: Athens, O., 18; Braintree, Mass., 30; Chehalis, Wash., 30; Bridgeport, Conn., 45; Portland, Me., 45; Brooklyn, N. Y., 90; Narragansett Pier, R. I., 30; Harrison, O., 35; Ashland, O., 70, Findlay, O., 45; Springfield, Vt., 35; Anderson, Ind.: 50; Salem, Va., 100; Athel, Mass., 25; Poughkeepsie, N. Y., 50; Beverly, Mass., 100; North Tonawanda, N. Y., 100; Lancaster, O., 50; Corning, N. Y., 50; Camden, N. J., 50; Lexington, Ky., 50; Catlettsburg, Ky., 50; Lockport, N. Y., 50; Noblesville, Ind., 50; Clinton, Ia., 50; Parkersburg, W. Va., 100; Lincoln, Neb., 150; Washington, D. C., 100; Put-in-Bay, O., 50; Bay City, Mich., 100; Syracuse, N. Y., 50; Newton, Mass., 50; Columbus, O., 50; Covington, Ky., 50; Newark, N. J., 100; Elwood, Md., 50; Key West, Fla., 50; Oakland, Cal., 50.

INCANDESCENT APPARATUS: Narragansett Pier, R. I., 1,300; Springfield, Vt., 650; Salem, Va., 1,300; Newton, Mass., 650; Key West, Fla., 1,950; Titusville, Fla., 400; New Haven, Conn., 400; Bay Shore, L. I., 400; Dunellin, N. J., 300; Shawnee, O., 300; Akron, O., 1,300; Camden, N. J., 1,300; Brooklyn, N. Y., 1,300; Lock Haven, Pa., 1,300; Iron Mountain, Mich., 1,950; Buena Vista, W. Va., 1,300; Norwalk, Conn., 1,300; Lexington, Ky., 1,300; Atlanta, Ga., 1,300; Waltham, Mass., 1,300; Tacoma, Wash., 2,600; Norristown, Tenn., 650; White River Junction, Vt., 650; New London, Conn., 650; Patchogue, L. I., 650; Martinville, Md., 650; Princeton, Md., 650; Bedford City, Va., 650; Millersby, O., 650; Milton, Mass., 650; Cohasset, Mass., 650; Catlettsburg, Ky., 650; Waco, Tex., 1,950.

ISOLATED PLANTS, ARC APPARATUS: Aluminium Carbon Co., Lancaster, Pa., 6; U. S. Emigration Depot, Ellis Island, N. Y. Harbor, 40; Palisades Amusement Co., 150.

ISOLATED PLANTS, INCANDESCENT APPARATUS: H. K. Hartzell, Catasauqua, Pa., 50; Fort Hamilton Brewing Co., Fort Hamilton, N. Y., 50; Bradbury-Stone Storage Battery Co., Lowell, Mass., 100; National Transit Co., Parkers Landing, N. Y., 100; N. Copeland, New York, 100; Henry Adams, Rockville, Conn., 150; Cutler Bros., Wakefield, Mass., 150; Blue Ridge Inn, Mount Airy, North Carolina, 200; Wainwright Real Estate Co., St. Louis, Mo., 2,000; Agnes Scott Institute, Decatur, Ga., 200; Croton Magnetic Iron Mine, Brewster, N. Y., 300; H. C. F. Koch, New York, 300; W. Engle & Co., Orono, Maine, 50; Cleveland Ship Building Co., Cleveland, O., 100; Consumers' Brewery Co., New York, N. Y., 400; Manufacturing Investment Co., Madison, Me., 400; A. C. Couch, New York, 200; W. E. Anderson, Blacksburg, Va., 400; Washington Loan and Trust Co., Washington, D. C., 860.

Foreign Electrical News.

A number of English light-houses are to have electrical connection with the main land.

Fares on the City and South London Underground Electric Railway have been reduced from two-pence to one penny.

A dynamo in a London electric lighting plant has made a run, without a rest of a single second, of 27 days 17¾ hours.

About £10,000 are to be expended by the German government on a cable connecting the Island of Heligoland with the Continent.

During the first week of the Frankfort Electrical Exhibition 29,773 persons visited it. This attendance was considered very satisfactory, in view of the inclement weather which prevailed at the time.

KINDRED INTERESTS

Blauvelt & Rowe have removed their office and factory to 353 Adams street, Brooklyn, N. Y.

The Novelty Electric Company, Philadelphia, have issued a voluminous and well illustrated catalogue of "everything electrical."

The Electric Merchandise Company, 11 Adams street, Chicago, report that they are receiving a large number of inquiries regarding the Burton electric heater from private parties as well as electric and steam railways.

The Ball Engine Company, Erie, Pa., have received the following:

Naugatuck, Conn., Feb. 23, 1891.
The Ball Engine Co., Erie, Pa.

Gentlemen—Your favor of the 21st inst. received, and beg leave to say that we have used one of your 60 horse-power engines for over four years with entire satisfaction, and are so pleased with its operations that we are now erecting a 200 horse-power Cross compound engine of your manufacture.

Very truly yours,
Per L. S. BEARDSLEY,
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Belts and Dressings.

Belts should be cleaned regularly, and after cleaning, a good belt dressing should be applied to keep the belt soft and elastic, and cause it to hug the pulley and transmit its greatest power. The use of a good belt dressing is superior in economy to any other method for correcting a slipping or slightly loose belt. The custom of tightening a belt whenever it slips is not a good one. The belt is liable to be made too tight, which heats the bearings and strains the belt. Great care, however, should be taken in selecting a belt dressing. Castor oil is an article in very general use, but experts have found that it contains an active acid principle, and is drying in its nature. The use of soap, rosin, tar, etc., cannot too strongly be condemned. They are only temporary stimulants and eventually destroy the belt. A belt dressing that is guaranteed to prevent slipping, and at the same time keep the leather soft and elastic, is certainly worthy of careful consideration. Such is Dixon's belt dressing, made and sold by the Jos. Dixon Crucible Company, Jersey City, N. J. There is no trouble in applying it, and all who have used it commend it in the highest terms.

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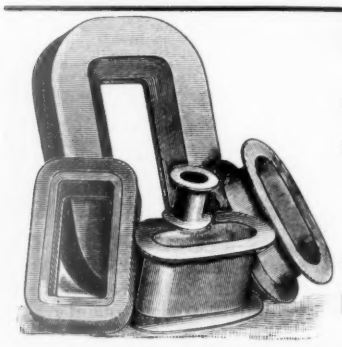

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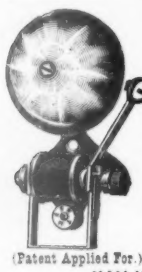

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ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON JUNE 16, 1891.

454,018 Electric signal for mine shafts; Frederick W. Bacorn, Marysville, Mont.

454,020 Electric railway car. 454,021 Electric motor car. 454,022 Conduit for electric railways; Edward M. Bentley, New York, N. Y.

454,023 Electric railway; Francis O. Blackwell, Boston, Mass., assignor to the Thomson-Houston Electric Co., of Connecticut.

454,024 Electric motor; Harry H. Blades, Detroit, Mich.

454,031 Electric switch; Horace T. Clark, Bridgeport, Conn.

454,038 Incandescent electric lamp controller; John J. Fanning, Chicago, Ill., assignor of one-half to John Bairstow, same place.

454,057 Galvanic battery; William Macmillan, New York, N. Y.

454,060 Insulated electric conductor; Edwin D. McCracken, Alpine, N. J., assignor to the Norwich Insulated Wire Co., New York, N. Y.

454,087 Electric locked switch; Francis Teague, London, County of Middlesex, England, assignor to John Abbott Iliffe, same place.

454,091 Secondary battery; Donato Tommasi, Paris, and Charles Theryc, Marseilles, France.

454,138 Bi-telephone; Ernest J. P. Mercadier, Paris, France.

454,155 Subway for electric wires; William Readman, Toronto, Canada, assignor to John Culmer Hurst, same place.

454,166 Mast-arm for electric lamps; Thomas Dillon, Indianapolis, Ind., assignor of one-half to John Caven, same place.

454,177 Conduit for underground or subway electric systems. 454,178 Motor car for underground electric systems. 454,179 Rail and road-bed for traction roads; John J. Miller, Pittsburgh, Pa.

454,181 Connector for electric wires; Edmund L. Nash, George G. Stout and Jesse R. Davis, Parkersburg, W. Va.

454,184 Electric head-light; Richard Pattison and Dennis G. Desmond, Boston, Mass.

454,187 Secondary battery; John S. Sellon, London, England, assignor, by mesne assignments, to the Accumulator Co., of New Jersey.

454,207 Electric resistance box; Rudolf Eickemeyer, Jr., Yonkers, N. Y.

454,226 Wall fixture for electrical conductors; Oscar H. Pieper and Frank M. Watson, San José, Cal.

454,238 Electric pole in gas or vapor explosive engines; Frank E. Tremper and John W. Eisenhuth, San Francisco, Cal.; said Eisenhuth assignor to the Electric Vapor Engine Co., same place.

454,253 Electric arc lamp; Powhatan Clarke, Baltimore, Md., assignor of one-half to Frederick H. Smith, same place.

454,262 Incandescent lamp filament; Thomas A. Edison, Llewellyn Park, N. J.

454,270 Electric current indicator; Albert B. Herrick, New York, N. Y.

454,275 Tubular electric conduit; Edward H. Johnson, New York, N. Y.

454,294 454,295 Electric arc lamp; Samuel W. Rushmore, Brooklyn, N. Y.

454,313 Electric apparatus for treating deafness; George F. Webb, Jefferson, Ohio.

454,326 Dynamo electric machine; Rudolf Eickemeyer, Yonkers, N. Y.

454,338 Electric telegraphic apparatus; Samuel V. B. Essick, Brooklyn, N. Y.

454,344 Electric block system for railways; Augustus H. R. Guiley, South Easton, Pa., assignor, by direct and mesne assignments, of two-thirds to Wilson B. Solliday, same place, and Elijah B. Cornell, Philadelphia, Pa.

454,381 Process of electro-deposition and cathode therefor; Alexander C. Reinfeld, Austria-Hungary.

454,443 Electric arc lamp; John E. McAuley, Chicago, Ill., assignor of one-half to Thomas F. Vaughn, same place.

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